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Battelle Technical Review

IN THIS ISSUE : Toward a Science of Gating Castings

VIGNETTE

FRANK M. STEPHENS, JR.

Emergent technologies, such as those based on the space sciences, readily accept revolutionary concepts. "In the production of the newer metals, also," states Frank M. Stephens, Jr., "we find a willingness to accept previously unorthodox methods. But in the extractive metallurgy of the conventional metals, where traditions may reach back over 10,000 years, new concepts often have hard going. With our growing populations and the huge new demands they will make for materials of all kinds," the Battelle extractive metallurgist concludes, "we must be prepared to find newer and better methods for effectively using the lower-grade ores upon which we must now increasingly depend."

Frank's research career began at Battelle in 1942, after graduation from the Colorado School of Mines with a degree in metallurgical engineering. In the beginning he had a foot in each of two camps—extractive and physical metallurgy. His early extractive-metallurgy studies were dictated by World War II needs for adequate domestic supplies of strategic metals. His other research involved investigations of the metallurgical practices that evolved in Japan and Germany as the conflict continued.

After the war, Frank concentrated on extractive metallurgy, participating in studies of most of the known techniques for a broad spectrum of metals and contributing to many new extractive processes. He and his colleagues were responsible for the improved roasting section of the salt-roasting flow sheet—used as a U. S. standard—in the Monticello (Utah) Uranium Mill. They contributed to the improvement of the alkaline leaching process for uranium, work recognized in the AEC's Geneva Conference volumes. Frank also had a key role in early major research on up-grading lower grades of iron ore. A paper based on the research received the *Journal of Metals* Award.

In other fields, Frank has guided development of fluidized-bed techniques for processing more than two dozen metals ranging from cadmium through molybdenum to zirconium. The techniques used in sulfate roasting of nonferrous metals, as adopted in various nations, stem from research by Frank and his colleagues. Their work on hydrometallurgy is reflected in the AEC's alkaline leaching sheet at Grand Junction, Colorado, in the AEC's ammonium leaching process, and in nickel and cobalt processes used around the world. And to mention only one more field of interest, he has been associated with volatilization processes for recovery of halides, carboniles, and volatile metals.

Among his current professional activities Frank counts membership in, and he is chairman-elect of, both the Chemical Processes Committee of the Society of Mining Engineers' Minerals Beneficiation Division and the Hydrometallurgy Committee of the Metallurgical Society's Extractive Metallurgy Division, of the American Institute of Mining, Metallurgical, and Petroleum Engineers. Chief of the Institute's extractive metallurgy division, he is author and coauthor of some 40 papers and other publications.

With his wife, Dwayne, Frank is often amused and confused by the activities of their son and three daughters. All of them enjoy Colorado vacations, with emphasis on fishing for Frank, mountain climbing for his son, and horseback riding for the feminine contingent in the family.

BATTELLE TECHNICAL REVIEW

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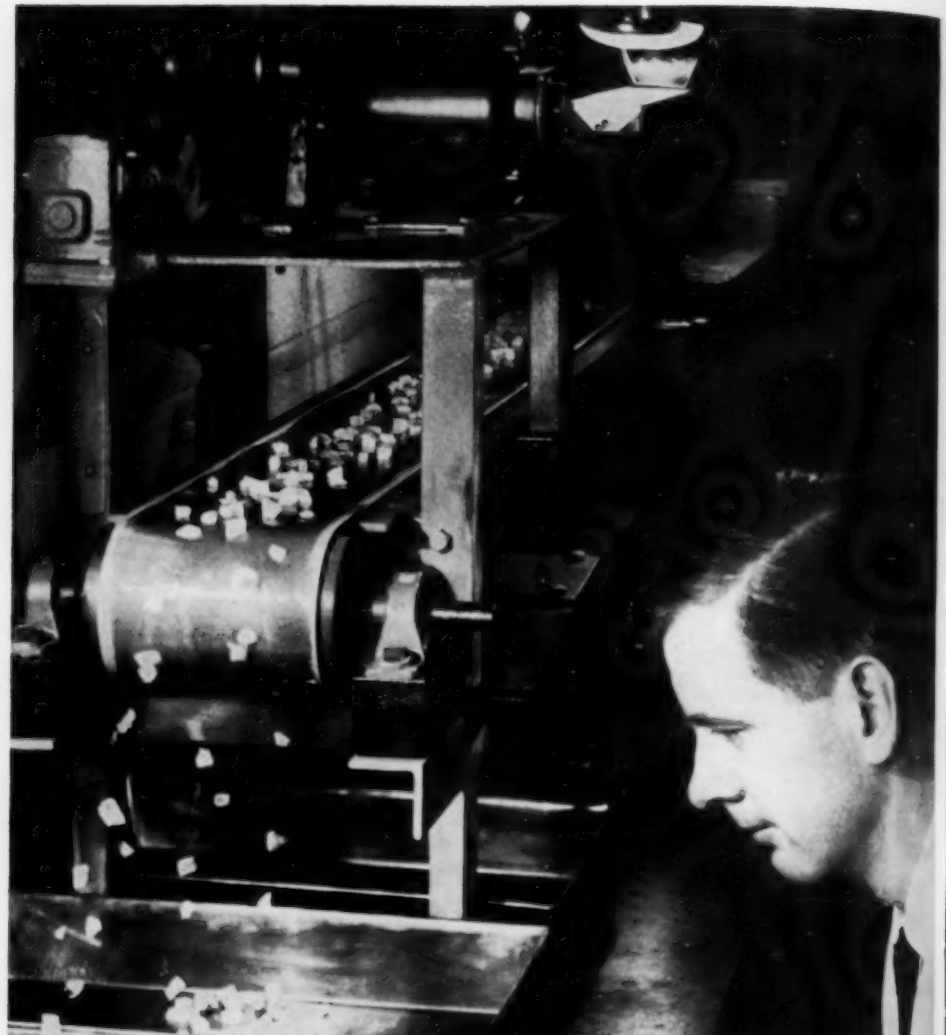


PROCESS FOR UPGRADING ROCK SALT

A laboratory model reveals the essentials of the recently-developed method for upgrading rock salt. Robert Brison is watching as the materials to be separated—rock salt and its impurities—move on a belt coated with heat-sensitive resin after having been heated by infrared irradiation. The pure salt, which absorbs little heat, remains relatively cool and is thrown off the belt into a bin (left). The impurities, however, since they absorb heat more readily, adhere briefly to the belt and fall into the other bins.

Brison and other minerals beneficiation specialists at Battelle developed the process for the International Salt Company, and the company is now using it to upgrade rock salt mined under the city of Detroit. Principles of the process are expected to prove valuable in a number of other industrial applications.

Toward a Science of Gating Castings

The production of clean castings depends largely upon sound gating practices. The author presents the scientific principles that underlie such practices.

by JOHN G. KURA

CASTING OF METALS IS A practice that dates back to well before the Christian era. The art was slow in its development because the knowledge of metal flow, so important to good casting, was still in a primitive state even to early modern times. Moreover, procedures were kept secret and were handed down from father to son by craftsmen.

As the metals industry developed, and provided a greater variety of metals and alloys in ever larger quantities, and as the system of mass production evolved, the value of reproducing many identical parts by casting techniques was recognized. Moreover, because the casting process enables production of identical parts of unusual shape with savings both in cost and time, it grew in importance as a method of metal forming.

Formation of the American Foundrymen's Association in 1896 (changed to the American Foundrymen's Society in 1948) in the United States, and other organizations in Europe initiated free exchange of knowledge that led to more rapid development of the casting industry. As a result, scientific methods have been developed and grafted onto the art of casting, leading to improved reliability. In this article, we will consider some of the developments in the gating of castings which promise great benefit to the casting industry.

Very simply, the casting process consists of melting the metal in a furnace and pouring the molten metal into a cavity in a mold. A casting may be very small or very large, as simple in shape as a plate or a sphere, or it may be extremely complex. The chief attribute of the casting process is its capability of producing shapes that often cannot be produced by other methods or cannot be produced so economically by other methods. The cavity in the mold is produced by embedding a pattern, a full-scale model of the desired casting, in the sand or other material and then withdrawing it. When the liquid metal poured into this cavity is frozen, it will accurately reproduce the shape of the pattern.

DEFINITION OF A GATING SYSTEM

Of the many factors that affect the quality of a casting, the gating system is recognized as being one of great importance; yet the principles under which it should function to provide satisfactory results are not well understood. The term "gating" is descriptive of a system of channels which characteristically leads molten metal into the mold cavity to form the casting. The ideal gating system should:

1. Reduce turbulence in the molten stream as the stream passes through the channels and into the mold cavity. Turbulence churns air into the metals, and the casting may be inferior because air bubbles or metal oxides (dross) become trapped in the casting.
2. Eliminate entrainment of air or mold gases by avoiding conditions that create aspiration of gas in the channels.
3. Decrease the velocity of the stream of molten metal, thereby minimizing erosion of the mold or excessive turbulence in the mold cavity.
4. Permit the mold to be filled fast enough so that premature freezing of the metal does not create defects.
5. Assist in developing thermal gradients in the solidifying casting so that shrinkage cavities can be filled by molten metal from risers.
6. Take the "art" out of pouring. The term "art" means personal capability to duplicate an achievement. It varies markedly between individuals and may vary considerably even for a given individual.

The greater the tendency of an alloy to form dross, the more important it is to know and use techniques that constitute the ideal gating system. Although some liberties may be taken in casting metals such as iron or tin bronze, much closer attention must be given to

details when casting aluminum and some of the copper alloys such as silicon bronze and manganese bronze because of their strong tendency to form dross.

The Significance of the Reynolds' Number

Hydraulics, the science that deals with fluids in motion, is basic to the study of the flow of liquid metals. The characterization of the flow of liquids in a channel, so important in hydraulic studies, is accomplished with a dimensionless number, called the Reynolds' number, obtained by use of the formula:

$$N_R = \frac{vd}{v}$$

where v is the velocity of liquid, cm/sec

d is the diameter of the channel, cm

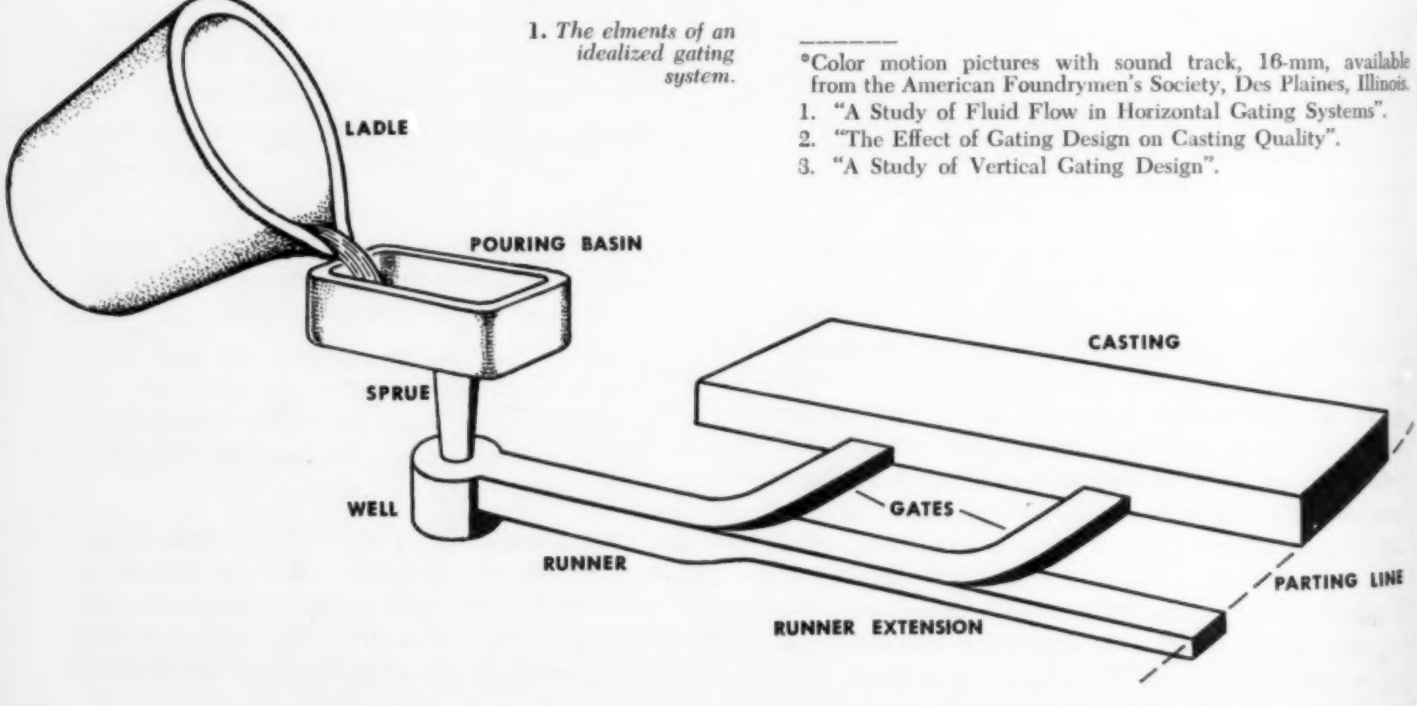
v is the kinematic viscosity of the liquid, cm^2/sec

Experiments have shown that at a Reynolds' number of 2000 or less, flow invariably is laminar, a condition seldom, if ever, achieved in commercial gating systems. For most of the practical situations in metal casting, turbulent flow is normally present because the Reynolds' number is considerably greater than 2000. Fortunately for the foundryman, however, two degrees of turbulence have been recognized. The one considered to be harmless in gating is that associated with a Reynolds' number below about 20,000; it is essentially harmless because the agitation accompanying it does not rupture the surface of the stream. But at a Reynolds' number above 20,000, agitation is so severe that the surface of the stream actually breaks and splashing occurs. Then dross formation and entrainment of air bubbles are very likely to follow.

The study of flow in gating systems is extremely difficult and restrictive when molten metals are used. During investigations at Battelle for the American Foundrymen's Society, it was discovered that water makes an ideal substitute for hot liquid metals. The kinematic viscosity of water is within the ranges of values for liquid metals as is shown in the following data:

	Kinematic Viscosity cm^2/sec
Water	0.0100
Aluminum	0.0127
Magnesium	0.0080
Copper	0.0040
Iron	0.0040 to 0.0150
Steel	0.0044

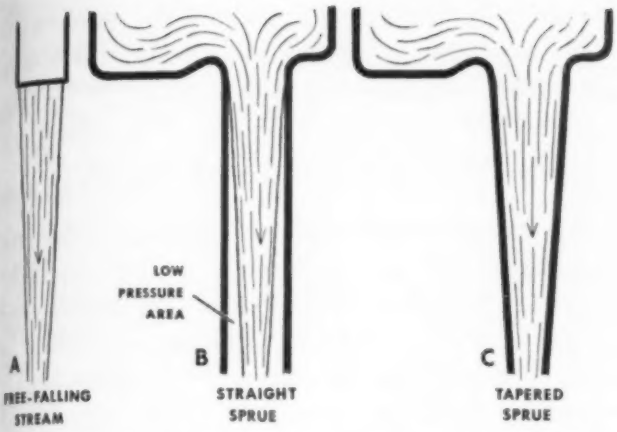
By utilizing transparent Lucite molds. the flow characteristics can be studied through the presence and movement of entrained air bubbles or by soluble dyes added to the water. Because action in the stream is too rapid for the eye, high-speed motion pictures were made and studied in evaluating various mold geometries. These films have since proved valuable in demonstrating the importance of sound basic principles in gating.*



1. *The elments of an idealized gating system.*

*Color motion pictures with sound track, 16-mm, available from the American Foundrymen's Society, Des Plaines, Illinois.

1. "A Study of Fluid Flow in Horizontal Gating Systems".
2. "The Effect of Gating Design on Casting Quality".
3. "A Study of Vertical Gating Design".



2. Good sprue design follows the natural form of a free-falling stream. A straight sprue tends to aspirate gases into the falling metal. A well-designed sprue (right) is narrowed at the bottom to hasten its filling by the molten metal.

Some Principles of Gating

The following discussion presents pertinent principles that were demonstrated in the laboratory and shows how they apply to the formulation of an ideal gating system. The ideal gating system, which evolved from the research conducted at Battelle, is described, and the principles underlying the features are explained.

The features of an idealized gating system as evolved in the studies are shown in Figure 1. For the system to function properly, two conditions must always be observed. It is necessary that: (1) the lip of the ladle be as close as possible to the pouring basin, and (2) the sprue be filled quickly and kept full at all times. Compliance with these two requirements helps to take much of the "art" out of pouring.

First, let us discuss the features of the gating system as shown in Figure 1. Note that the sprue is tapered to the bottom. The size of its bottom opening controls the rate at which the mold will be filled. At the start of the pour, the well beneath the sprue fills and serves as a cushion to help in preventing erosion by the rest of the falling liquid metal, which is at its highest velocity at that point. Since the gates come off the top of the runner, the liquid will not enter them until the runner is full. And because dross clings to the surfaces of a full runner, metal is cleaner as it enters the gates. The extension of the runner beyond the last gate helps to trap the liquid containing dross and air that was entrained during the turbulence associated with the filling of the spruce and runner. Streamline flow is maintained in the liquid leaving the runner and entering the gates by the generous radius of curvature of the gates where they are attached to the runner.

The design of the sprue requires careful study. Consider the shape of a stream of water issuing from a faucet. As illustrated in Figure 2, the cross section of the stream decreases as it falls. We know that the velocity of the stream increases the farther it falls because the velocity of a free falling body is given by

$$v = \sqrt{2gh}$$

where g is the acceleration due to gravity, and

h is the distance of fall.

We also know from the law of continuity that the volume of liquid flowing in a full channel is the same at all points in the channel. Assume for convenience that the stream coming from the faucet is making its own channel in the air. Then the volume of liquid flowing per second in this channel is given by

$$V = A_T v_T = A_B v_B, \text{ where}$$

A_T is the area at the top of the channel

v_T is the velocity at the top of the channel

A_B is the area at the bottom of the channel

v_B is the velocity at the bottom of the channel.

Because the velocity is higher at the bottom than at the top of the channel, the law of continuity shows that the area must be smaller at the bottom than at the top. This then accounts for the tapered shape of the stream leaving the faucet. Since a falling stream will have a tapered shape, the sprue should also have a tapered shape to accommodate the stream. In practice, as shown in Figure 2C, the sprue should be tapered somewhat more than is required to conform to the shape of a free falling stream to assure that positive pressure is exerted by the liquid on the sidewalls of the sprue. When a sprue is straight rather than tapered, the falling stream within it will want to form its own tapered shape, as illustrated in Figure 2B. In so doing, considerable agitation may occur in the falling stream. In addition, a low-pressure area develops in the gap that forms between the stream and the sprue wall. The low pressure in this area will cause aspiration of air and mold gases which then are churned into the stream, damaging the metal. Aspiration would continue until the liquid, its movement slowed by the filling of the mold cavity, builds up in the straight sprue and eventually fills the sprue. But in the meantime, the considerable volume of metal already poured would have been damaged.

Newton's first law states that a body in motion will continue to move in a given direction until some other force is exerted on it to change the direction. This law

helps to explain the need for streamlining the channels of a gating system.

Consider that liquid is flowing in a large channel connected to a smaller one as illustrated in Figure 3B. The liquid that fills the corners in the large channel forces the stream to flow toward the centerline of the channel. Also, because of the law of continuity, the velocity is increased as the stream enters the smaller channel. The higher velocity and the fact that the stream had been forced toward the middle of the channel cause the stream to leap around the corner, creating another low-pressure area. In a gating system with such discontinuities in its channels, mold gases could be aspirated at the low-pressure areas and become thoroughly churned into the liquid metal.

A low-pressure area can also develop when the stream is flowing in a small channel connected to a larger one. As illustrated in Figure 3C, the stream wants to continue in a straight line as it leaves the small channel, but as it jumps the corner, a low-pressure area is developed. In a similar manner, a low-pressure area is developed at a corner when the channel sharply changes direction (Figure 3A).

Obviously, transitions in the sizes of connecting channels should be gradual, and sharp turns should be redesigned to insure streamlined flow. The application of these rules is illustrated in Figure 2 showing a radius where the pouring basin is attached to the sprue. In Figure 1 a generous radius is used where the runner or the gates change the direction of the stream. The rules also help to explain why runner chokes—localized obstructions for decreasing the cross section of channels so as to trap dross in the liquid—are fundamentally unsound. Their main function actually is to control the flow rate, which they accomplish very effectively, but at the cost of aspirated gases in the metal. Utilizing the proper size opening for the bottom of the sprue, on the other hand, assures effective control of the flow rate, and without the attendant damage to the metal.

Calculating the Gating System

The literature describes many empirical methods for calculating the rate at which a casting should be poured. The descriptions are useful as a starting point if no experience exists for making a decision. In general, the pouring rate, should be no higher than is necessary to fill the mold cavity completely. If, in certain instances, temperature gradients in the solidifying casting are affected by the pouring rate, they also would need to be considered in determining the pouring rate.

Assuming that the flow rate is known, the opening of the bottom of the tapered sprue can be calculated from the general equation

$$A_B = \frac{2W\ (h - \sqrt{ah})}{C\rho\sqrt{2gh}\ (h-a)}$$, where

W is the flow rate

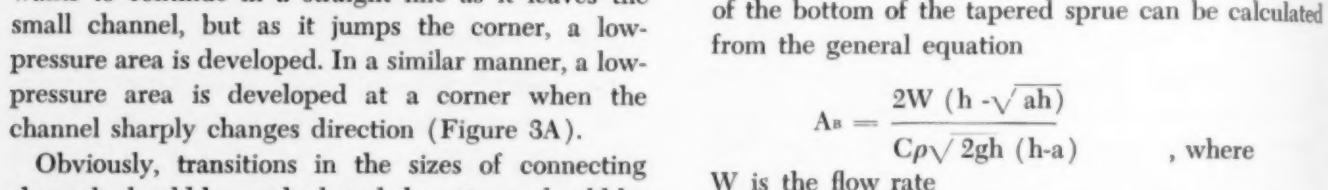
h is the distance from the top of the sprue to the bottom of the mold cavity

a is the distance from the top of the sprue to the top of the mold cavity

ρ is the density of the liquid metal

g is the acceleration due to gravity, and

C is a constant to correct for the friction losses in in sprues of different shape, e.g. 0.88 for a round tapered sprue, 0.47 for a round untapered sprue, 0.74 for a square tapered sprue.



3. *How irregularities in channels of gating systems affect metal flow. Low-pressure areas are points at which mold gases can be aspirated and churned into the liquid metal.*

The area of the opening at the top of the sprue is obtained from

$$A_T = A_B \sqrt{\frac{h_1}{b}}$$, where

h_1 is the length of the sprue and

b is the depth of liquid in the pouring basin

It is important to realize that the larger the diameter at the top of the sprue, the greater must be the depth of liquid in the pouring basin. Otherwise a vortex action will start in the pool above the sprue opening and dross and air will be sucked down into the sprue. For example, a sprue entrance 1 inch in diameter requires at least 2½ inch depth of liquid in the basin to prevent the formation of a vortex. The vortex will form less readily if the sprue opening is square or rectangular rather than circular.

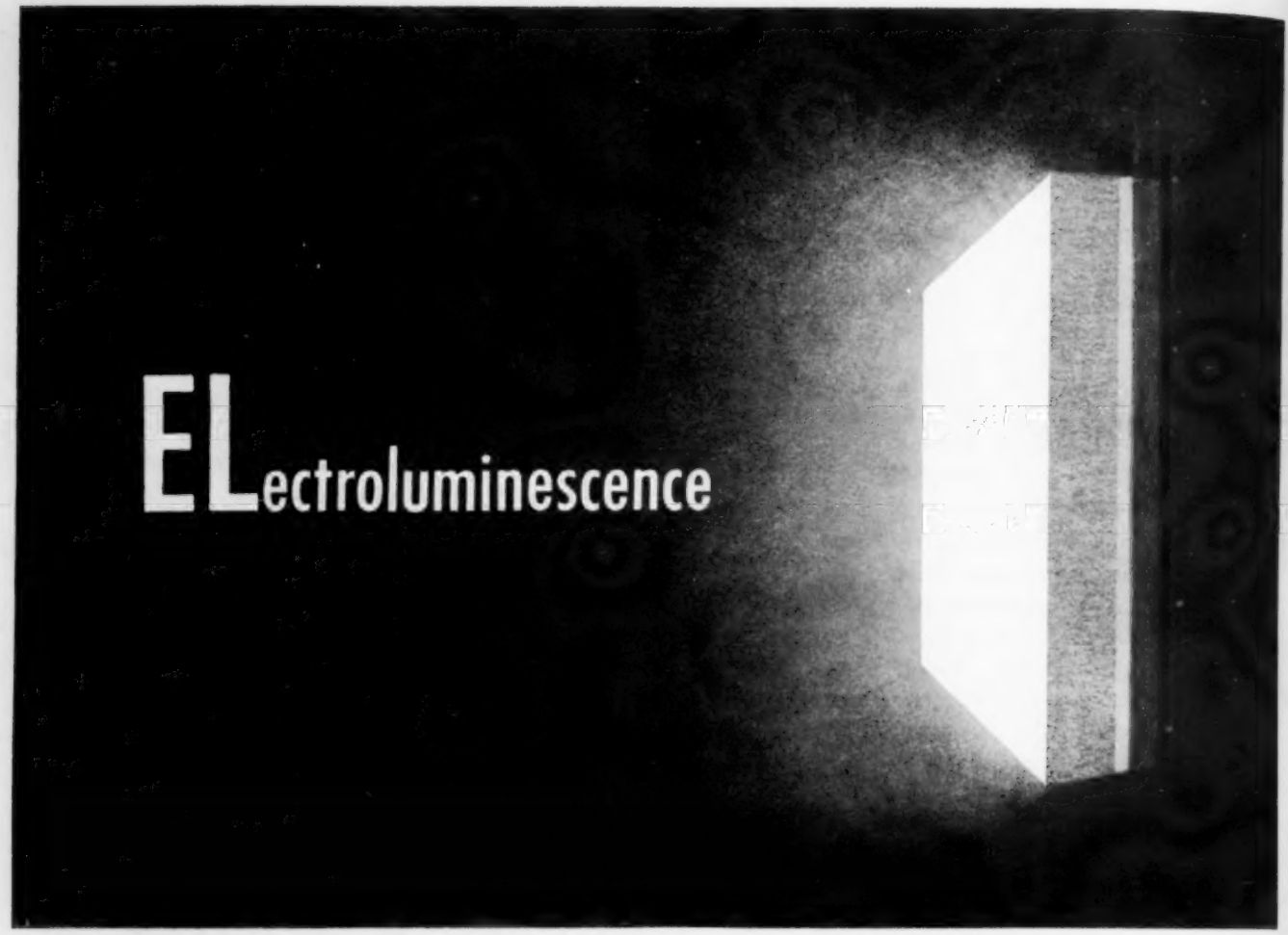
The dimensions of the well at the bottom of the sprue can be calculated from empirical relationships evolved through laboratory experiments. Studies at Battelle indicate the following relationships. For a narrow, deep runner, the diameter of the well should be 2½ times the width of the runner in a two-runner system and twice its width in a one-runner system. In the example discussed above, the well's depth should equal the depth of the runner. For square, round, or wide, shallow runners, the well should have a horizontal cross-sectional area 5 times the area of the bottom of the sprue, and a depth twice that of the runner. Wells made according to these relationships will avoid the development of the damaging low-pressure area illustrated in Figure 3A, and will be quickly freed of the first liquid, which may be damaged in coming down the sprue.

The dimensions of runners and gates are also important to good casting since areal relationships control the velocity and turbulence of the metal as it flows into the mold cavity. Thus, a stream velocity in the gate that is one-fourth the velocity at the bottom of the sprue may be desired. Such a gate velocity is attained through a gating system expressed as 1 : 4 : 4. This expression gives the area ratios of the sprue to the runner to the gates, which means that the cross-sectional area of the runner at the sprue is 4 times the area of the bottom of the sprue, and the total area of the gates coming off the runner is also 4 times the area of the bottom of the sprue. Thus, by the law of continuity, the stream velocity in each gate will be one-fourth the velocity of the flow at the bottom of the sprue.

When more than one gate is attached to a runner, other dimensional factors must be given consideration. In the case of multiple gates leading from a runner of constant cross-sectional area, most of the metal will tend to pass through the gate farthest from the sprue. Once the runner is full, momentum of flow will develop pressure first at the end of the runner, so the gate nearest the end will carry the heaviest flow. It is possible, however, to obtain approximately equal and simultaneous flow in all gates leading from a runner. This can be done by reducing the runner in size, just beyond the point where each consecutive gate leads off, by an amount equal to the cross-sectional area of the gate (as illustrated in Figure 1). The consecutive reductions in the runner provide additional resistance to the flowing stream. Once the runner is full, sufficient pressure is developed at each gate to assure almost simultaneous flow through all gates into the mold cavity.

From what has been briefly touched upon here, it is evident that science is applicable in the development of superior gating systems. The extent to which principles need to be used is dependent upon the degree of cleanliness desired in the casting, the design of the casting, and the type of metal being cast. Many so-called tricks are used successfully in various commerical foundries to produce acceptable castings. Upon close analysis, invariably these tricks can be shown to be unique applications of principles. Intelligent application of principles in designing the gating system can lead to more consistent production of high-quality castings.

John Kura's association with Battelle has been marked by a series of significant metallurgical developments. One of the most important of these has been his 12-year study of the fluid-flow characteristics and basic principles of gating systems, the results of which are already reflected in commercial metal casting. He had a key role in creating a recently-perfected process for cladding steel wire with aluminum and participated in the development of other bimetallic bonding and cladding techniques. The inventor of an inert mold material, Kura has also contributed to the development of of controlled-atmosphere, cold-crucible furnaces and of consumable-electrode and induction-melting furnaces. Other research in which he has participated includes development of a high-strength, high-conductivity zirconium-copper alloy and studies leading to dip-galvanizing and aluminizing processes.



1. *Electroluminescent panel. Layers employed in its construction are, left to right, glass, transparent conducting film, phosphor-dielectric layer, and metallic sheet.*

Interest in electroluminescence has grown rapidly in recent years, yet many important problems related to its development remain to be solved. Here is a discussion of the basic principles, materials, and uses associated with the phenomenon.

by MILTON R. SEILER *and* CHARLES S. PEET

MAN HAS CONTINUALLY SOUGHT methods of generating artificial light. Fire, in the form of the burning log, the candle, the oil lamp, and the gas mantle was his only resort from early times until the practical utilization of electricity. At present we seem largely content with the incadescent filament and the fluorescent lamp, as commonly used for household and industrial lighting. Yet, these are only a few of the possible means of light generation from an electrical stimulus. Today modern man utilizes not only visible light, but the entire electromagnetic spectrum for industrial, military defense, and research applications.

G. Destriau, in 1936, was first to observe "electroluminescence" (EL). He discovered that selected phosphors exhibited a faint visible light when they were stimulated by an alternating electric field. Improvement in the emission intensity has progressed slowly since that time, perhaps because there has been no sense of urgency or critical need for a product. Recently, EL has received greater attention because research has shown that it offers reduced heating effects, uniform source intensity over a flat surface, a variety of pleasant colors, and in some cases, a reduction in system volume in comparison with conventional

lighting systems. Potential applications exist in the lighting, display, and control industries. For the scientist, EL demands study for the insight it provides into the nature of matter.

In practice, EL devices utilize a phosphor powder, typically zinc sulphide activated with copper, which is mixed uniformly into a dielectric medium such as mineral oil or various transparent plastics and resins. The mixture is applied in a thin film, generally on the order of a mil in thickness, to a flat electrode surface. A transparent conductive coating, as in Figure 1, is then placed on the opposite side of the film, thus forming the basic electroluminescent cell with the proper means for generating the electric field and enabling the viewing of the visible emission. Cell sizes from one to several inches square are convenient for study. Whereas a fluorescent lamp may yield about 60 lumens per watt of electrical power input, and a tungsten filament lamp 15 to 30 lumens per watt, electroluminescence can offer about 3 to 5 lumens per watt under 60 cycle-per-second excitation. Close inspection of an EL panel under magnification will reveal spotty, localized emission rather than equal intensity from every phosphor grain. To achieve more efficient utilization of the entire phosphor material is the difficult objective of present research efforts.

Basic Principles of EL

The intensity of emission from an EL panel is influenced by the magnitude and frequency of the applied voltage. At a given frequency, the brightness increases rapidly with voltage, V, in a manner approximating the expression

$$B = A\, e^{-b/V}$$

where B is the brightness and A and b are constants for a particular panel. At a fixed voltage, the emission increases with increasing frequency in a nearly linear manner until some optimum frequency, usually on the order of 1000 to 20,000 cycles per second, is reached. The electric field intensity within the phosphor particle can be estimated from the Maxwell-Wagner equation, which evolved from a treatment of crystal spheres within a dielectric medium. Specifically it predicts the following:

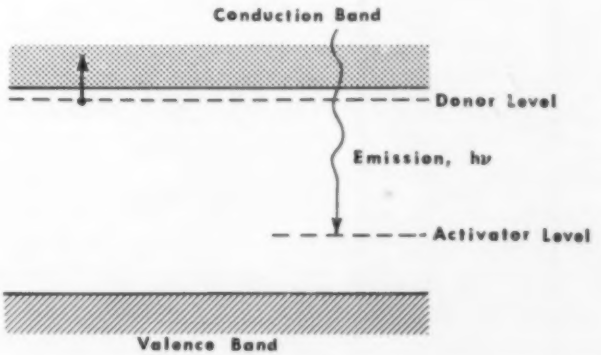
$$\frac{E_c}{E_o} = \frac{3\ K_d}{K_d(2 + r) + K_c(1 - r)}$$

where E_c is the electric field within the crystal, E_o is the mean electric field, K_c is the dielectric constant of the crystal, K_d is the dielectric constant of the dielectric binder, and r is the ratio of crystal volume to total volume. In general r is small compared to unity, so that $\frac{E_c}{E_o}$ may be greater than unity if K_d is greater than K_c. In the practical application we are dealing with irregular grains rather than spheres, but the above relation at least indicates the advantage of a high-dielectric-constant binder.

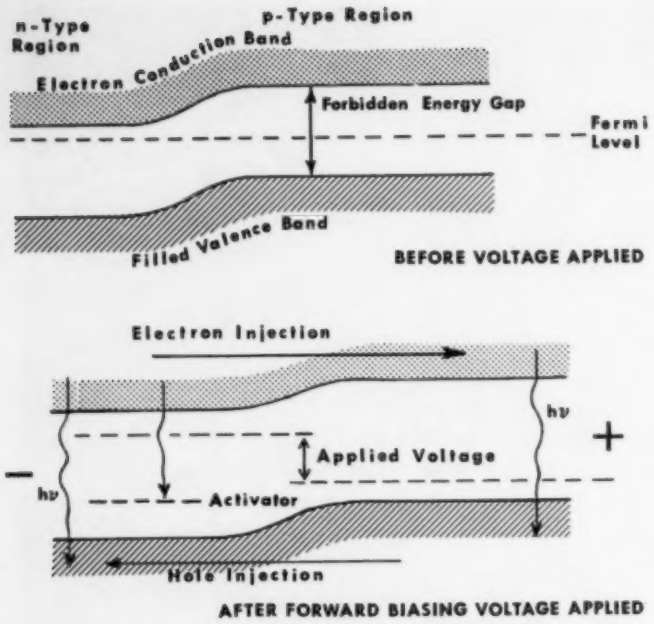
The dielectric binder must also be chemically inert to the phosphor, be transparent to the phosphor emission, possess a high dielectric strength to prevent electrical breakdown, and have a low dissipation factor. The amount of wasted power that is generated as heat in the completed panel is dependent upon this dissipation factor. These heating effects not only represent an inefficient utilization of electrical power, but, if excessive, may raise the temperature of the panel to a point where the phosphor emission is reduced. Most useful phosphors have their strongest emission at or near room temperature, so the binder affects the amount of power one may apply to an EL panel. Approximately 100 watts per square foot of panel may be applied in short periods; 10 watts per square foot is a safe limit for continuous operation. Even if about 300 lumens per square foot could be obtained (an efficiency of 30 lumens per watt with a power loading of 10 watts/square foot), this brightness is still less than that of a 40-watt bulb.

The transparent conductive coating in Figure 1 is usually a tin oxide or bismuth oxide and gold film on a glass substrate. The requirement for high transparency conflicts with the need for a low electrical resistance, but a transparency of at least 80 per cent can usually be achieved without detrimental resistance effects.

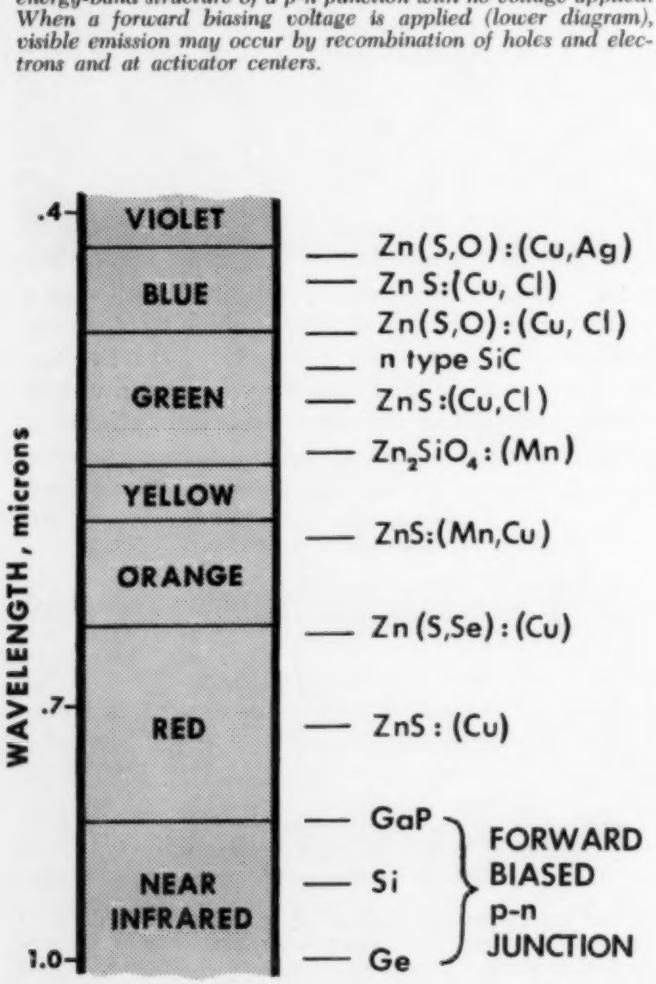
The completed panel may be treated as a capacitor.



2. *The energy-band mechanism of typical electroluminescent phosphors. Electrons from donor levels lying close to the conduction band are liberated by the applied electric field. These electrons accelerate to greater energies in the conduction band and collide with activator centers. The released energy appears as visible emission.*



3. *Energy-band structures of a p-n junction illustrating recombination electroluminescence. The diagram above illustrates the energy-band structure of a p-n punction with no voltage applied. When a forward biasing voltage is applied (lower diagram), visible emission may occur by recombination of holes and electrons and at activator centers.*



4. *Colors available from EL phosphors. Colors may be influenced by changes in frequency and by steps in phosphor preparation.*

A film thickness near one mil usually produces a capacitance of about 100 micro-micro-farads per square centimeter of area. Conceivably EL lighting may be attractive from the standpoint that it's capacitive nature could improve the electrical power factor in industrial plants having highly inductive loading.

The basic mechanism of electrolminescence is under debate by many workers, but it is largely agreed that electrons within the phosphor must first be accelerated by the electric field, the acquired energy being released as radiation upon collision of the electron with what may be regarded as a "luminescent or activator center". (See Figure 2). The complete theory must account for energy-absorbing processes, transport of energy by electrons through the crystal lattice, and energy-trapping mechanisms.

Related Phenomena

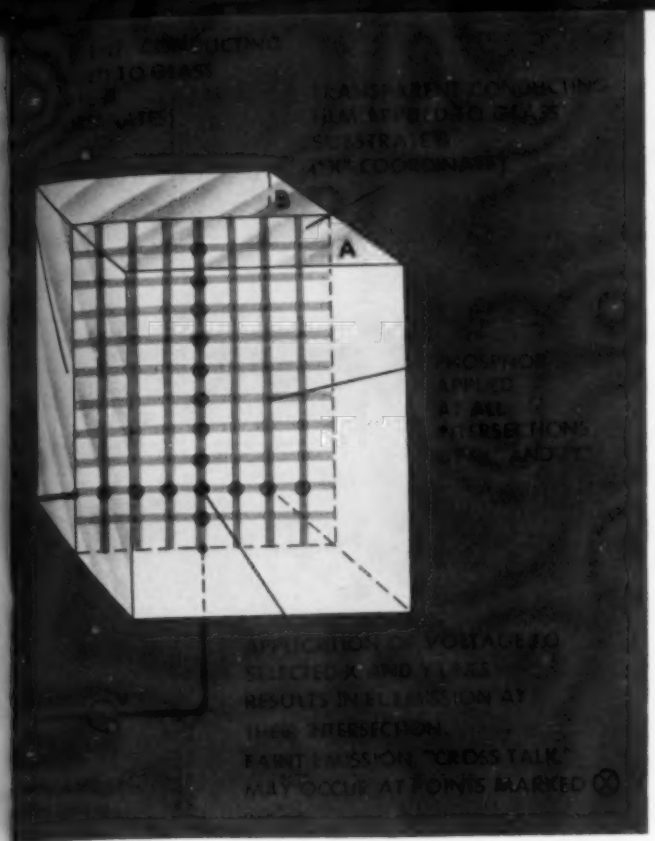
To avoid confusion with related effects, there is a growing tendency to classify the simple term "electroluminescence" as emission arising solely from an alternating electric field. Some other pheonmena of interest, which are closely related to EL, are the following:

Carrier-Injection Electroluminescence. In various semiconductor p-n junctions, such as silicon, germanium, and gallium phosphide, emission has been observed when the junction is forward biased. The emission results from the injection of minority carriers and their subsequent recombination, as shown in Figure 3. This process is sometimes called "recombination electroluminescence". If the p-n junction is biased in the reverse direction, avalanche mechanisms can account for emission which has been observed in gallium phosphide and various other semiconductors. In any event, the term "carrier injection", in a broad sense, includes all of the above.

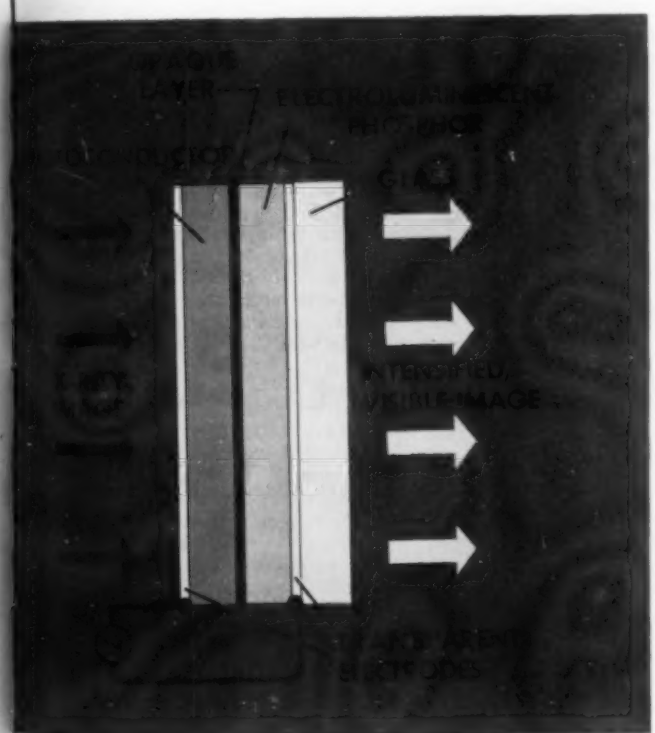
Electrophotoluminescence. The presence of electromagnetic energy, in addition to the applied electric field, may promote or quench the emission. For example, the presense of infrared radiation is known to quench the emission of certain zinc-sulfide phosphors. Infrared detection schemes based on this principle have been used experimentally, but to date the effects have proved to be too insensitive to be useful.

Thermoluminescence. A few of the natural minerals, such as selected pieces of limestone and granite will luminesce if their temperature is raised. The increased temperature releases stored energy accumulated over many years from incident X-ray or gamma-ray radiation.

Fluorescence. Luminescence stimulated by electro-



5. An El display using and X-Y grid construction. Each conductive line has its own energizing circuit which can be controlled individually. But any line, or all of them, may be energized at any one time, thus making possible the presentation of a controlled moving image. Switching speeds are determined by the response-time of the phosphors.



6. The light amplifier. An image upon the photoconductor reduces the resistance according to its light pattern. The image is then reproduced more brightly in the glowing phosphor layer.

magnetic radiation, decaying to zero in about 10^{-8} seconds after stimulation is removed.

Phosphorescence. Luminescence which continues for a significant time after the stimulation ceases. Phosphorescent paints are available on light switches, curb markers, and many nocturnal safety applications.

Materials

Electroluminescent phosphors are generally fluorescent under ultraviolet radiation. The reverse is not true since fluorescent phosphors do not normally have sufficient impurity or "activator" concentration for electroluminescence. The latter requires activators in the ratio of about two parts per thousand while fluorescence may require only one hundredth of this concentration.

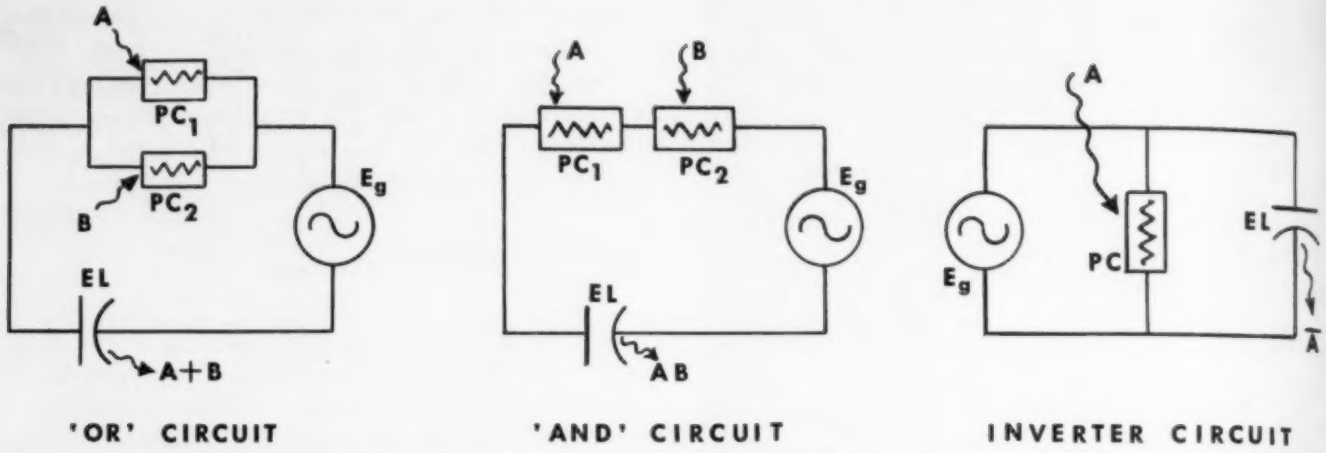
The most notable electroluminescent phosphors include zinc sulphide, cadmium sulphide, and zinc and cadmium sulfide-selenide mixtures. Other phosphors include cadmium telluride and zinc silicate. Activators are generally copper, manganese, and lead. Chlorine is usually used as a co-activator with copper in zinc sulfide.

Figure 4 illustrates the variety of colors available. As noted, emission into the infrared spectrum has been observed. Some phosphors are known to change emission color as the applied frequency is increased. Zinc sulfide activated with copper and lead ZnS: (Cu,Pb) changes from green to blue and ZnS: (Cu,Mn) changes from yellow to blue with increasing frequency. Steps in the preparation of the phosphors, such as firing time and temperature, can also influence their color.

Present Applications

At present, electroluminescent emission is less efficient than other common lighting systems, so one must pay a premium in electrical power if high intensities are to be achieved. Obviously, EL is most practical where high intensity is unnecessary. It is especially advantageous where the flat construction offered by EL panels is desirable, or where EL in conjunction with other phenomena may offer an intriguing scheme for information display or electronic circuit control. Some known devices for lighting include darkroom safety light, instrument panel gauges, clock dials, theater fixtures, and night lights.

Information display offers a more diverse field for electroluminescent applications. The phosphor and



7. Electroluminescent-photoconductive cell combinations for circuit logic. A and B represent arbitrary light sources impinging on photoconductive cells (PC). E_g represents an alternating-current voltage source.

conducting films may be applied in any number of patterns, such as numbers, letters, or abstract symbols. For example, imagine the conducting films to be applied in an x-y coordinate configuration, (Figure 5): selected regions of the dielectric may be excited by simultaneous application of voltage to line "x" and line "y". With rapid "scanning" of the input to the x-y grid, a moving image may be presented in much the same manner as the image is formed on a television screen. One difficulty is the presence of "cross-talk", which is the unwanted, faint emission from adjacent phosphors on the same x or y coordinate. This blurring of the image can be reduced and conceivably eliminated by simultaneously applying a biasing voltage to all regions where emission is unwanted. For rapid information processing a rather complex pattern of exciting and biasing pulses, all with proper phase orientation, must be programmed into the panel. Practical systems of this type are now limited to about 15 conducting lines per inch; applications for finer resolution and greater information rates can usually employ the electron bombardment of a phosphor screen (cathodoluminescence) to better advantage.

Another display application is image intensification, or conversion, shown in Figure 6. To understand how it works let us suppose that a photoconductive layer with an impedance at least 100 times that of the EL layer is imposed within the "sandwich". With no incident image on the photoconductive layer, a minor portion of the applied voltage is across the electroluminescent layer and little or no emission will occur. An incident image will reduce the resistance of the photoconductor in localized areas corresponding to the image pattern; consequently, a greater portion of the applied voltage will appear across the EL layer and a faithful reproduction of the image will be emitted. The photoconductor may be sensitive to X-rays, or to visible energy. In many cases an opaque layer between the EL phosphor and photoconductor may be necessary to eliminate prolonged image storing through feedback action from the EL emission. Gains in image energy as high as a thousand have been reported. In the case of X-ray

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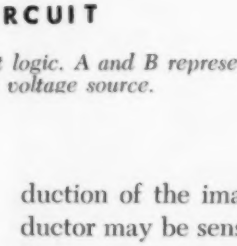
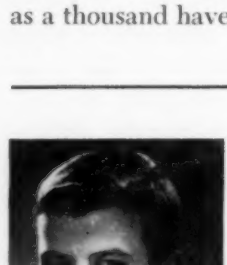


For some time, Milton Seiler has had a deep interest in both the fundamental and practical aspects of electroluminescence and its applications. He has been concerned, too, with problems of information display for military purposes. Among his other research at Battelle, Seiler has been associated with studies on applications of thermoelectric cooling and thermoelectric power generation and magnetoresistance for voltage regulation. He has contributed also to investigations of thermal radiation and emittance properties of semiconductors at elevated temperatures.



Charles Peet has long been concerned with the research task of finding means for making use of the properties of solid-state devices. He is currently interested in the study of nonequilibrium charge-carrier distributions and recombination phenomena. In recent years, he has guided research on transistors, rectifiers, and fluorescent materials, and Peet and his colleagues have conducted studies on thermoelectric, infrared, and galvano-magnetic effects. Under his guidance ,also, are studies in the fields of thin-film devices, thermionic emitters, and gaseous electronics. The Electrochemical Society's *Abstracts of Literature on Semiconductors and Fluorescent Materials and Their Applications* is prepared annually under his guidance.

photography, the image intensifier may provide the means for reducing patient-exposure time as well as the accumulated exposure of the X-ray technician.

Possible Applications

Recent studies and improvements have revealed other potential uses. As previously indicated, the x-y grid of photoconductor and electroluminescent layers is limited in utility because of the complex sequential switching necessary. If the image is to be flicker free, the elements require continuous, rather than pulsed, excitation. The solution is to provide for information storage within the panel. Thus, the "ELF" system incorporates ferroelectric ceramics and EL phosphors in a display screen. The output image is controlled by the electric charge pattern in the ferroelectrics. A charge pattern, and consequently an image, may be stored for as long as several minutes. Yet, information may be changed at microsecond switching intervals.

Logic and control networks employing a combination of photoconductive (PC) and EL cells offer another potential application. It is highly desirable in computer operations to obtain electrical isolation between read-in, storage, and read-out circuits. Figure 7 illustrates some basic circuit logic which is obtainable with these PC-EL pairs. By starting with such fundamental circuits, one can conceive of systems using the EL emission to illuminate other photoconductors, which in turn control other EL cells, and so on in this manner until the desired circuit function is obtained. Thus, electrical isolation is achieved, the coupling being entirely by optical radiation. Logic systems using optical coupling have low switching rates, the response times of the PC and EL cells being the limiting factors. If fast switching is unnecessary, the EL cells are advantageous from the standpoint that their brightness can increase nearly 25 times for a unit change in applied voltage.

The Future of EL

At present, EL research efforts are largely divided into two categories: (1) attempts to understand better the fundamental physical principles underlying the observed visible emission, and (2) improved methods for fabricating the EL panels or display systems. The former efforts are of interest to the basic-research scientist, the latter to the practical engineer. In many instances, EL panel construction has become an art, rather than a science, because there is still insufficient understanding of the basic mechanisms.

It is suggested that if the efficiency of EL phosphors is eventually to be improved to a position competitive with conventional lighting system, it will be necessary to initiate programs which closely integrate the following research efforts:

(a) Control and understanding of phosphor composition.

(b) Theoretical analysis of observed emission properties.

(c) Improved understanding of the role of the dielectric binder, and its required properties for optimization of EL emission.

(d) Phosphor particle-size effects and optimum volume ratio of EL phosphor to dielectric.

(e) Reduction of resistance in transparent conductive coatings without sacrifice in transparency.

In the meantime, device studies and market evaluation should proceed to determine additional uses for EL in its present state of development. As previously discussed, EL is not limited to lighting systems. Information display, image intensification, and other applications offer a promising future for electroluminescence.

"The peril of ignorance grows as man's curiosity and technical advances thrust him ever deeper into contact with matter he does not fully understand and with forces he does not fully comprehend."

Harry Bell McClure, vice president, Union Carbide Chemical

NOTES from BATTELLE

POTENTIAL REACTOR FUELS

Uranium mononitride, uranium sulfide, and uranium silicides are potential reactor fuels which could provide a big payoff from increased research according to a Battelle report presented before the American Society for Metals—Atomic Energy Commission Joint Conference.

The report, prepared by Battelle reactor metallurgist R. F. Dickerson, critically evaluates all uranium compounds with the objective of picking those which would produce the most return per research dollar invested.

Because of the advanced state of their technology, uranium dioxide and uranium carbides were mentioned as having the greatest current potential. However, according to Dickerson, uranium mononitride, uranium sulfide, and the uranium silicides could well be developed into reactor fuels that would help provide economic nuclear power. Uranium beryllide (UBe_{13}) should also be considered worthy of research investment, even though it would be suitable only for use in a compact reactor system. Uranium borides prepared with boron-11 should also be seriously considered.

The criteria used to eliminate compounds from consideration were chemical instability, low thermal-neutron efficiency, low uranium density, and low melting point, or a combination of these properties. On the basis of these criteria and other available data, the materials listed were chosen from 62 uranium compounds.

SMALL-SCALE IRON PRODUCTION

For many companies, the ability to produce pig iron in relatively small volume (up to 500 tons per day) has been a long-time need. One of the serious limitations upon such production has been the relatively high cost of metal produced in such small amounts. After more than a decade of research involving the McWane Cast Iron Pipe Company, the McDowell Company, Inc., and Battelle, a process has been developed that meets the challenge. The research has led to a method of matching products and cost typical of large-scale production with small-scale plants.

According to H. W. Lownie, Jr., who directed the Institute research, Battelle studies indicated that a fast, and low-cost, partial prereduction and preheating of ore could be combined with a fast, low-cost final smelting operation so that the total operation can be carried on either continuously or intermittently.

The 500-tons-per-day plant as finally developed by McWane and McDowell, costs about $6 to $7 million to build. The production cost of iron in such a plant can be as low as about $40 per net ton of pig or hot metal and depends largely upon going costs in various locations.

The new D-LM process, as it is called, has some important advantages even over blast furnaces. It lends itself to intermittent operations if they are required. The raw-materials requirements are more flexible than for the larger furnaces—iron ore fines or concentrates normally requiring agglomeration may be used, and low-quality fines of noncoking coal are acceptable. Also important is the fact that capital requirements are less than half the cost of the conventional blast furnace with coke plant.

WOOD PRODUCTION STUDY

A comprehensive study of wood production in southeastern United States is now under way. The study has been authorized by a group of firms interested in the progress of the wood-products industry in that region. The need for a cooperative research effort was recognized by the Southeastern Technical Committee of the American Pulpwood Association, and the Association will coordinate the study, currently on a three-year schedule.

One purpose of the project, according to Dr. Frank C. Croxton, who will direct the research at Battelle, is to study existing methods of producing wood and, by applying modern techniques of research and analysis, to discover ways for more efficient harvesting and transportation of forest products from the stump to the consumer. If the information developed suggests usable technological improvements, woodland owners, loggers, dealers, consumers, and the general public stand to benefit, he observed. "Indeed the economy of whole communities in the Southeast that are heavily dependent on the forest-products industry could be improved."

Specialists will study the use of manpower and equipment to determine how these factors influence wood production and transportation to the user. Since weather conditions greatly affect operations of the forest products industry, the effects of weather on men and machines will be considered in detail.

Dr. Croxton pointed out that it is difficult at this initial stage of the project to describe more specifically Battelle's approach to the problem. The study could, he indicated, result eventually in recommendations for better use of existing wood-harvesting and -handling equipment or in improved designs for such equipment.

At present, a research team including economists, industrial engineers, mechanical design engineers, and operations-research experts, is gathering information on many facets of the problem. Much of the information will have to come from field work. The region under study includes Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

ELECTROLYTIC MACHINING

An electrolytic machining process than can shape parts from the toughest alloys in as little as one-tenth the time required by conventional machine tools has been developed at Battelle in research supported by the Steel Improvement and Forge Company, of Cleveland.

The process removes metal without arcs, sparks, or high temperatures by passing direct current between the workpiece and an electrolyte. The current removes electrons from the workpiece, converting the surface atoms into positively charged ions that dissolve into the electrolyte. Because its effectiveness is not dependent on the hardness of the metal, the process offers a solution to the problem of machining the harder, higher-strength metals.

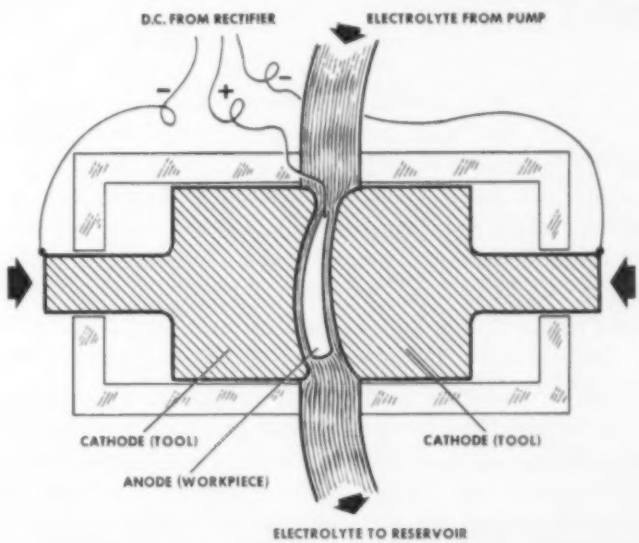
To produce a part, a rough forging or piece of metal stock (anode) is placed between shaped electrodes (cathode), and electrolyte is pumped under pressure into the space between the electodes and the workpiece. As the electric current dissolves the workpiece to the desired shape, the electrodes are moved in simultaneously.

The electrolytic unit has machined rough-forged jet turbine blades to 0.003-inch tolerances in 5 to 10 minutes—an operation which takes from 1 to 2 hours to perform by grinding. In addition to shaping parts, other types of units can be used to sink die cavities in 50 minutes which require 7 to 10 hours of machining time. They also can drill round and irregularly shaped holes in alloys that cannot be penetrated by conventional drills. For some applications the processes' big advantage is not the time saved, but the absence of mechanical damage to the surface of the workpiece.

Because there is no tool pressure on the workpiece, very thin sections can be shaped without deformation, and lightweight machines and clamping systems can be used. Also, the shaping process produces no metallurgical change on the surface of the workpiece as conventional machining does.

The development of the electrolytic-machining process is the result of over two-and-a-half years of work by a Battelle research team which included Dr. Charles L. Faust, chief of electrochemical research at the Institute; Dr. John A. Gurklis; and John E. Clifford.

According to Dr. Faust, the Battelle-developed process differs from others which use the electrolytic metal



Below. *Experimental model of machining equipment utilizing the electrolytic process developed at Battelle. Dr. John A. Gurklis is adjusting the equipment.* **Above.** *Diagram of the main components of the electrolytic machining process.*

removal principle in that: (1) it can produce complete parts in addition to sinking cavities, (2) it uses no rotating cutting wheels, (3) power is supplied through a simple rectifier instead of complex electronic circuits.

Current requirements for the electrolytic machining process range up to 1500 amp per square inch of workpiece at 3 to 12 volts, to achieve a penetration rate of 0.05 to 0.1 inch per minute. However, for most operations a 100-500 amp per square inch current is sufficient. The shaped electrodes, which are not subject to wear, can be made of any electrically conductive material. The electrolytes, selected according to the metal to be machined, are solutions of readily available commercial chemicals.

* HIGH-SPEED SHAFT SEALS

A major research program to provide a more basic understanding of factors involved in the design and use of high-speed rotary-shaft face seals has just begun at Battelle. The program is being jointly sponsored by "more than a dozen large American manufacturing companies interested in advancing shaft-seal technology", according to C. M. Allen, specialist in bearings, seals, and lubrication technology at the Institute.

In explaining the new program, the Battelle technologist pointed out that the leakage of high-speed mechanical shaft seals has posed a serious problem in the design and operation of advanced high-speed turbomachinery. "Shaft seals operating at 50,000 to 100,000 revolutions per minute and higher are now designed into modern turbocompressors, as for example, in the accessory equipment for commercial jet aircraft. We can expect high-speed seal-design and leakage problems to become critical as the use of high-speed turboequipment becomes more universally employed. Our own research experience in this area and the number of inquiries we have received suggest strongly that, in the absence of a well-developed technology, many seal problems have had to be solved by expensive cut-and-try methods that contribute little to the general improvement of seals."

Now on a one-year schedule, the program will be directed toward the dynamic behavior of high-speed liquid-lubricated face seals. Basic experimental data will be obtained on the performance of such seals, with special emphasis on the behavior of the primary seal elements. By carefully planning and conducting these seal experiments, it will be possible to control and monitor the behavior of the entire seal system and its supporting structure. Analysis of data obtained in these experiments will make it possible to evaluate the importance of the various parameters involved. The program is expected to provide seal-design data of direct value in the design, installation, and application of high-speed rotary-shaft face seals and machinery.

Principal investigators for the program are Frederick K. Orcutt and J. Clarence Bell.

* The discovery of a new mineral—a cubic copper-arsenic sulfide—was announced by Battelle geologist Dr. Charles B. Sclar at the recent annual meeting of the Geological Society of America in Denver. Co-discoverer is Matija Drovenik, mining geologist for the Bor Copper Mining Comporation, Bor, Yugoslovia, where the mineral was found. It has been named lazarevićite in honor of M. Lararević, the pioneer investigator of the geology and ore deposits of the Bor region from 1908 to 1913.

Lazarevićite, which occurs as microscopic grains in copper ore associated with enargite, luzonite, covellite, and pyrite, was discovered during the course of a Battelle study on the mineralogy and geochemistry of germanium in sulfide copper ore. The study was sponsored by the Bor Mining Corporation.

According to Dr. Sclar, the discovery of lazarevićite is significant in two respects. First, its composition (Cu_3AsS_4 ideally) approaches the previously unknown arsenic-rich end of the sulvanite-arsenosulvanite [Cu_3Vs_4-$Cu_3(V, As)S_4$] atomic substitution series. Second, lazarevićite, with cubic symmetry, represents the third known polymorphic form of copper-arsenic (Cu_3AsS_4).

* Battelle staff members recently named to technical posts include: *C. Malcolm Allen*—member, Editorial Review Committee, Rolling Element Bearings, *and* member, Editorial Review Committee, Sliding Bearings, American Society of Lubrication Engineers; *John M. Blocher, Jr.*—member, Aerospace Manufacturing Techniques Panel, Materials Advisory Board, National Academy of Science - National Research Council; *James M. Dugan*—chairman, Intaglio Processes Subcommittee, Photomechanics and Platemaking Committee, Research and Engineering Council of the Graphic Arts Industry; *William A. Glaeser* and *Frederic K. Orcutt*—vice chairmen-at-large, Bearings and Bearing Lubrication Committee, American Society of Lubrication Engineers; *Daun Peterseim*—member, Committee on Combustible Metals, National Protection Association; *Abbott A. Putnam*—member, Committee C-20 on Accoustical Materials, American Society for Testing Materials.

Writings by STAFF Members

Component Evaluation and Specification Engineering. Test Data on Task XV. Resistor, Variable, Subminiature. Vol. I of II. PB 137 806; 1955, pp. 194. (LC mi $8.70, ph $50.30)

Reports results of tests on 861 specimens procured from six manufacteurers. The investigated characteristics included initial resistance and linearity; rotational vibrational, and load life; moisture resistance; low temperature storage and operation; and temperature coefficient measurements.

The Effect of Nuclear Radiation on Structural Metals. B. C. Allen, et al. PB 147 103; *REIC Report No. 5*, May 31, 1958, pp. 43. (LC mi $3.30 ph $7.80)

Presents the state of the art on the effects of nuclear radiation on structural metals from 1943 through 1957. Experimental evidence to date indicates that structural metals are quite resistant to nuclear radiation when compared to such things as organic compounds or electronic components. Fast neutrons in integrated flux levels above 10^{19} vnt represent the only reactor radiation that can significantly affect the properites of structural nonfissionable metals.

The Effect of Nuclear Radiation on Semiconductor Materials (First Addendum). L. W. Aukerman. PB 147 101-S-1, *REIC Report No. 1* (Addendum), March 31, 1959, pp. 36. (LC mi $3.00 ph $6.30)

The literature on the effects of high-energy-radiation on semiconductor materials received by the Radiation Effects Information Center during 1958 and 1959 is reviewed and compared. The materials covered are Ge, Si, and several compound semiconductors including AlSb, InSb, InAs, GaSb, and GaAs. All types of irradiation capable of producing permanent damage are considered. A rather serious discrepancy between theory and experiment appears to be present in most cases investigated.

Selected References on Making High-Temperature Alloys by Powder Metallurgy. Vincent D. Barth. *DMIC Memorandum* 47, PB 161 197; March 18, 1960, pp. 6. (OTS $0.50)

Two of the most important factors to be considered are sintering atmospheres and the problem of securing an equilibrium or near-equilibrium alloy structure.

Theoretical Investigation and Design Studies for the Eventual Construction of a Measuring Device in the Field of Plasma Electronics. Battelle-Institut E. V., Frankfurt-am Main. PB 146 043; Annual Report No. 1, December 31, 1959, pp. 22. (LC mi $2.70, ph $4.80)

Theoretical analyses were made on the possibility of measuring the properties of plasma. The studies included properties of the ionosphere, examination of errors in the determination of location of bodies, planning of experiments for measurement of the properties of plasma, and preliminary experimental tests for frequency control and use of electromagnetic waves passing through a plasma.

Electroplated Metals on Uranium. J. G. Beach. U. S. Atomic Energy Commission, BMI-912, June 18, 1959, pp. 33. (LC mi $3.00, ph $6.30)

Electrodeposited Al, Cr, Cu, Fe, Mn, Ni, Pd, Sn, and Zn were investigated. Four factors were found to influence the corrosion protection uranium by electroplated metals: uranium surface preparation, method of deposition, type and thickness of electroplated metal, and conditions of heat treating required to diffusion-alloy the electrodeposited metal with the surface layer of the uranium.

Evaluation of Transport Integrals for Mixed Scattering and Application to Galvanomagnetic Effects. A. C. Beer, J. A. Armstrong, and I. N. Greenberg. Battelle Memorial Institute, March 15, 1957, pp. 28. PB 127500. (LC mi $2.70, ph $4.80)

The Johnson-Whitesell evaluations of the conductivity integrals were extended over large ranges of magnetic field and impurity scattering parameters. Values are given for the first thermoelectric integral. Use of the magnetic field dependence of galvanomagnetic and thermomagnetic properties to study charge-carrier scattering is discussed. Applications of the functions in the analysis of Hall effect, Corbino magnetoresistance, and thermomagnetic phenomena as functions of magnetic field are illustrated.

Too Hot for Hydraulics? Try Pneumatics for High-Temp Systems. John W. Billheimer and John K. Wetherbee. *Product Engineering*, v. 31, no. 43, October 17, 1960, pp. 68-69.

Electromagnetic devices normally used for amplifying and controlling output and input signals are not reliable at extremely high temperatures. The fluid amplifier developed at the Army's Diamond Ordnance Fuze Lab is used for this purpose. Principle of operation is simply the deflection of a high-power stream of gas by a low-power stream at right angles to it. In effect, the high-power stream is "aimed" by the low. Useful temperature can be extremely high—it is limited only by the metal or ceramic chosen. Speed of response of a pneumatic amplifier is slower than that of an electronic version; it is roughly in the ratio of the speed of sound to the speed of light.

Electron-Microscopic Observations on Radiation Damage in Graphite. W. Bollmann. *Philosophical Magazine*, v. 5, ser. 8, June, 1960, pp. 621-624.

Transmission electron microscopy was applied to the study of lattice defects introduced by neutron irradiation. The dark-field technique proved to be especially useful for this purpose. The technique of preparation is described and a tentative interpretation of the observations is given.

Review of Problems in Using Flat-Rolled Materials in Air- and Space-Weapon Systems. F. W. Boulger. PB 161 202. DMIC Memorandum 52, April 14, 1960, pp. 20. (OTS $0.50)

It has been estimated that, within five years, materials will be expected to operate at 1200 F for reasonably long times and at or above 200 F for a few minutes. Within ten years, operational temperatures are expected to reach 2500 F for a few minutes and 4000 F for a life of a few seconds. This review deals mainly with problems in producing and using sheet materials intended for service at high temperatures.

Research on Wood Finishes. B. G. Brand, L. J. Nowacki, and H. N. Johnston. *Forest Products Journal*, v. 10, July 1960, pp. 329-333.

Describes the nature of technological improvements which were made in wood finishes for exterior use, floors, furniture, and marine applications. Discusses means which are potentially suitable for making further improvements.

The Development of Minimum Design Data on the New Titanium Alloys Being Considered in the Titanium Sheet-Rolling Program. W. W. Breindel, et al. PB 147 733; *Quarterly Report No. 4*, February 20, 1958, pp. 17. (LC mi $2.40 ph $3.30)

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The effect of the ratio of the pin diameter to sheet thickness on the bearing strength is discussed. The decision was made to investigate this relationship for heat-treated 6 Al-4V Ti alloy. The use of the single shear-type specimen is illustrated by the presentation of additional data. Compression test procedures are described, and data are presented on annealed 6 Al-4V Ti alloy at testing temperatures of 80, 400, 600, 800, and 900 F. A tension apparatus was evaluated which permits the use of the same extensometer as that used for compression tests.

Notes on Mechanical Testing Techniques at Very Low Temperatures. James E. Campbell. *DMIC Memorandum 43*, PB 161 193; February 19, 1960, pp. 8. (OTS $0.50)

Discusses hardness tests, impact tests, tensile tests, fatigue tests, torion testing and strain measurement at low temperatures.

Genetic Influences on Iso-Immunization in the Rabbit. Carl Cohen. *Journal of Immunology*, v. 85, no. 2, August, 1960, pp. 144-147.

The production of iso-antibody is not simply a factor of donor-recipient incompatibility. Certain donor-recipient combinations, involving the same incompatible antigens, have different probabilities of antibody production. Antibody productivity may reflect the balance between compatible and incompatible units in an antigenic complex and the relative strength of the incompatible antigens.

The Effect of Nuclear Radiation on Lubricants and Hydraulic Fluids (First Addendum). S. L. Cosgrove. PB 147 102-S-1; *REIC Report No. 4* (Addendum), March 31, 1959, pp. 51. (LC mi $3.60 ph $9.30)

Radiation-resistant gas-turbine-lubricant development during the past year has centered around the expanded study of polyphenyl ethers and alkylated aromatic ethers. Alkylated diphenyl ethers and diaryl alkanes show the most promise for use in conventional hydraulic systems under irradiation conditions. The combination of radiation-stable fluids and modified soap (terephthalamates) or nonsoap thickeners has resulted in greases of adequate radiation stability for anticipated ANP needs. Likewise, commercially available dry-film lubricants show adequate radiation stability for anticipated ANP applications.

Evaluation of Dry Powdered Lubricants at 1000 F in a Modified Four-Ball Wear Machine. S. L. Cosgrove, L. B. Sibley, and C. M. Allen. *ASLE, Transactions*, v. 2, no. 2, May, 1960, pp. 217-224.

Data were obtained at 1000 F for sliding speeds of 120 and 700 ft per min under initial Hertzian contact stresses of about 250,000 psi. Conventional solid lubricant material such as lead oxide (litharge), molybdenum disulfide, and graphite were evaluated. A new dry solid lubricant, metal-free phthalocyanine, was studied and was usually found to have superior lubricating ability. Wear specimens of AISI type M-1 tool steel and titanium carbide-nickel-molybdenum cermet showed the most promise for high-temperature sliding systems. Initial coefficients of friction less than 0.1 were obtained with combinations of these materials.

The Effect of Nuclear Radiation on Lubricants and Hydraulic Fluids. S. L. Cosgrove. P. B. 147 102; *REIC Report No. 4*, April 30, 1958, pp. 80. (LC mi $4.50 ph $12.30)

A brief review of the mechanism by which organic materials degrade chemically under the influence of nuclear radiation is followed by a discussion of the radiation stability of current aircraft lubricants and hydraulic fluids. In general, military-specification aircraft lubricants and hydraulic fluids show inadequate radiation stability for projected *ANP* purposes.

Niobium—Promising High-Temperrature Reactor-Core Material. J. A. DeMastry and R. F. Dickerson. *Nucleonics*, v. 18, September, 1960, pp. 87 + 5.

Among refractory metals, Nb stands out for reactor use at over 1600 F. It offers—along with low capture cross section—high-strength alloys, fabricability, and stability in nonoxidizing environments.

GCRE Critical-Assembly Studies. David A. Dingee, et al. Battelle Memorial Institute, BMI-1288, September 10, 1958, pp. 98. (LC mi $5.40 ph $15.30)

Critical-assembly studies were made to provide engineering and physics data to aid in developing the Gas Cooled Reactor Experiment-I(GCRE-I). Measurements of critical mass, flux and power distributions, and shutdown worth of the GCRE-I mock-up safety and control blades were obtained.

High-Temperature Properties and Alloying Behavior of the Refractory Platinum-Group Metals. R. W. Douglass, F. C. Holden, and R. I. Jaffee. PB 161 823; August 14, 1959, pp. 127. (OTS $2.75)

A survey of the literature pertaining to the platinum-group metals and their alloys was made. Major emphasis was placed on the four more refractory metals: Rh, Ir, Os, and Ru. A selected bibliography and a list of references are included.

Metallurgical and Mechanical Characteristics of High-Purity Titanium-Base Alloys. Richard W. Douglass, et al. *WADC Technical Report* 9-595, PB 161 817; March, 1960, pp. 154. (OTS $3.00)

The relationships between mechanical properties, alloy composition, microstructure, and thermal history were studied. The alloy systems investigated include Ti-V, Ti-Cr, and Ti-W binary alloys, and Ti-Al-V, Ti-Al-Cr, Ti-Q-V, Ti-O-Cr, and Ti-O-Mn ternary alloys. Mechanical-property data include tensile and flow properties impact behavior, hardness, aging, and cooling-rate data. The effects of dispersions on the creep of Ti-W, Ti-Cu, and Ti-Si alloys were investigated.

Experimental and Research Work in Neutron Dosimetry. J. E. Drennan, et al. PB 147 981; *Quarterly Progress Report No. 2*, November 15, 1959, pp. 39. (LC mi $3.00 ph $6.30)

Experiments were carried out to investigate the sensitivity of two sets of experimental units to pure gamma radiation and to the fast-neutron radiation in the Battelle Research Reactor. Theoretical investigations were conducted to establish the expected relative sensitivity of the dosimeter rectifiers to gamma, thermal-neutrons, and fast-neutron radiation. A study of the device performance characteristics in relation to the practical read-out circuitry possibilities was conducted.

Experimental and Research Work in Neutron Dosimetry. J. E. Drennan and C. S. Peet. PB 147 980; *Quarterly Progress Report No. 1*, August 15, 1959, pp. 10. LC mi $1.80 ph $1.80)

Processing techniques for the preparation of wide-base conductivity-modulated, silicon-diffused rectifiers are used for the preparation of a set of experimental units. These techniques provide a base from which any modifications can be made. A statistically designed experimental program was initiated which should be useful for determining the optimum geometry and forward voltage for the conductivity.

A Method for Measurement of the Heat Formation of Silicon Carbide. J. W. Droege and J. F. Foster. PB 148 094; AFCRC-TR-60-139, April 30, 1960, pp. 21. (LC mi $2.70 ph $4.80)

Sodium peroxide calorimetry was investigated as a method for the determination of the heat of formation. Zirconium was found to be a suitable container material; corrosion losses amounted to no more than a few milligrams in each experiment. Reaction with the fuels SiC, Si, and C was not complete, but the reaction product could be analyzed for unreacted sample. Benzoic acid was used as a combustion aid and oxygen at 5 atm as an oxidation promotor. The method seems well suited to the SiC determination.

Printability and Wearability. James M. Dugan. Paper from *TAGA*, Proceedings of the 11th Annual Meeting, June 15-17, 1959, Technical Association of the Graphic Arts, Inc., Rochester, New York. 1959, pp. 213-217.

Physical evidence, in the form of photomicrographs of damaged letterpress plates and gravure etchings, shows how long-run printing quality may be sacrificed to first-proof quality. This evidence seems to warrant introducing a wearability factor into any definition of printability. Problems of wearability impose no insurmountable obstacles in the press room. Measures are suggested whereby these effects of wearability may be recognized and eliminated.

A Fundamental Approach to Single Solution Etching. James M. Dugan. *Gravure*, v. 6, July, 1960, pp. 20 + 4.

Research has shown that the number of etching solutions can be reduced to one and that a time-scale can be established to perform the etching step in the preparation of gravure cylinders. Further development of the techniques that are explained could lead to electronic control cylinder preparation.

Notes on the Diffusion Bonding of Metals. R. M. Evans. *DMIC Memorandum* 53, PB 161 203; April 20, 1960, pp. 9. (OTS $0.50)

The open literature is replete with reports on fundamental studies of diffusion phenomena. Most of these have not been directed toward bonding per se, but rather toward learning more about the fundamental reactions that take place. The metals-joining industry is in need of the basic research and development work required to indicate better the problems and their solutions. With such information, a precise science of diffusion bonding can be delineated for joining the complex alloys available today and being developed for the future.

Problems with Restraint in Heavy Weldments. Glenn E. Faulkner. PB 161 204; *DMIC Memorandum* 54, April 29, 1960, pp. 6. (OTS $0.50)

The Bureau of Naval Weapons, in conjunction with the Bureau of Ships, is initiating research under the Titanium Alloy Sheet Rolling Program to evaluate thick titanium plate for use in deep-diving submarines. One of the important phases of this research is the evaluation of welded joints in thick titanium-alloy plates. As part of the weld-evaluation program, procedures will be developed for welding 2-inch-thick plates. These plates will be 30 inches long. Restraint in weldments of this size is high. This memorandum is the text of a talk presented at the Titanium Alloy Sheet Rolling Panel Meeting, January 18, 1960, in San Diego.

Recent Developments in Titanium Brazing. G. E. Faulkner and W. J. Lewis. *DMIC Memorandum* 45, PB 161 195; March 4, 1960, pp. 8. (OTS $0.50)

Brazing filler metals, brazing methods, mechanical properties of brazed joints, effects of brazing cycles on base-metal properties are discussed.

Fatigue Data on Precipitation-Hardenable Stainless Steels. R. J. Favor, H. J. Grover, and W. P. Achbach. PB 161 196; *DMIC Memorandum* 46, March 11, 1960, pp. 15. (OTS $0.50)

Summarizes available stress-lifetime data (S-N curves) for 17-7 PH sheet and wire, and AM 350 sheet. A limited amount of data resulting from rotating-bending of AM 355 bar stock is included.

What Are the Combined Effects of Temperature and Very High Pressure on Metals? R. B. Fischer. *Journal of Metals*, v. 12, September, 1960, pp. 700-702.

The inception of high-pressure, high-temperature operation has opened many new avenues of investigation. The article discusses the possible effects of both on electrical resistance, ductility, hardening, and other mechanical and structural properties of metals.

Protective Coatings for High-Temperature Metals Alloys. C. G. Harman, E. F. Fowler, and L. S. O'Bannon. U. S. Atomic Energy Commission, BMI-804, December 15, 1952, pp. 28 (LC mi $2.70, ph $4.80)

Presents the results obtained in a preliminary study of ceramic-type coatings for stainless steel. The investigation was confined to a few three-component glasses composed of Na_2O, SrO, and SiO_2, with and without additions of clay. The goal of the investigation was to develop simple basis compositions which might later be altered by additional components to produce coatings with good adherence, no spalling or flaking due to thermal-shock cycling, and good protective properties in air at 1900 F. A glass composed of 26.9% of Na_2O, 21.5% of SrO, and 51.6% of SiO_2 had good adherence, fair resistance to spalling, and appeared to have fair protective properties.

Measurement of Thermoelectric Properties by Using Peltier Heat. T. C. Harman, J. H. Cahn, and M. J. Logan. Paper from Thermoelectricity, pp. 235-255, 1960. John Wiley & Sons, New York.

Various techniques for the measurement of thermal conductivity have appeared in the literature. The most common are the comparison method and the absolute method. In both methods it is somewhat difficult to eliminate extraneous heat transfer to the specimen, especially in the case of small specimens of low thermal conductivity. A new technique is presented which is useful for low thermal conductivity materials of small dimensions.

Brasing for High-Temperature Service A.. F. Haskins and R. M. Evans. *DMIC Memorandum* 48, PB 161 198; March 29, 1960, pp. 14. (OTS $0.50)

Summarizes the extent of advancement in the field of brazing for service temperatures in excess of 600 F. Until recently, the silver-base and copper-base alloys were the most common in the brazing field. These alloys were not suitable for high-temperature service. The nickel-chromium-iron alloys were the first to be used for high-temperature service. Nickel-base alloys, especially those containing Cr, exhibit good high-temperature strength and oxidation resistance.

Evaluation of the Zone-Purification Process as a Method of Preparation of Portable Water From Sea Water. R. C. Himes, et al. PB 161 818; *Office of Saline Water Research and Development Report No. 36*, May 1960, pp. 32. (OTS $1.00)

Experimental evidence has definitely linked periodic salt entrapments (characteristically observed along ingots grown in this research program) with breakdown of constitutional supercooling. The shape of the solid-liquid interface and crystallization rates at various solution concentrations are important factors in the zone refining and directional freezing of salt water. The technical feasibility of multiple-stage zone-freezing conversion of sea water has been demonstrated. Preliminary engineering evaluation of several multiple-stage, continuous freezing systems has indicated that at least one may be economically feasible.

Paper from *Symposium on Newer Metals*, Special Technical Publication No. 272 ,American Society for Testing Materials, 1959, contains the following writings by staff members:

High-Temperature Mechanical Properties of Tantalum. F. C. Holden, F. R. Schwartzberg, and R. I. Jaffee, pp. 36-55.

Recrystallization, tensile, and creep-rupture behavior of high-purity Ta and two interstitial-containing Ta alloys were determined. After a 75% cold reduction, Ta was completely recrystallized on annealing 1 hour at 1200 C; this temperature was increased slightly by adding 560 ppm O. The influence of interstitials in causing discontinuous yielding could be correlated with diffusivities. The moderate (25,000 to 32,000 psi) tensile strength of unalloyed Ta can be increased by cold working and by minor additions of interstitials. The creep resistance of Ta is increased by interstitial additions at short times and moderate temperatures, but is relatively unaffected at higher temperatures and longer times. Cold work remains effective in strengthening Ta up to 750 C.

Tensile Properties of the Platinum-Group Metals. F. C. Holden, R. W. Douglass, and R. I. Jaffee, pp. 68-79.

Tests were conducted on Ru, Rh, Pd, Ir, and Pt over a range of temperatures from −196 to 1000 C. Evidence of twinning and recrystallization was observed for most of these metals, the maximum temperature for twinning ranging from 25 C for pt to 1000 C for Ru. A plot of tensile strengths *versus* homologous temperature showed that Ir, Rh, and possibly Ru are considerably stronger than Pd and Pt.

Development of Refractory Metal Sheet in the United States. R. I. Jaffee, W. J. Harris, Jr., and N. E. Promisel. *Journal of the Less-Common Metals*, v. 2, nos. 2/4, April/August, 1960, pp. 95-103.

The new airframe applications for refractory metals in aircrafts, missiles, and space vehicles will require primarily sheet. Development of high-quality sheet products and components of the four major refractory metals is being accelerated in the U. S. Emphasis is being placed on relatively thin gage sheet of normal sizes, but with exceptional surface quality and gage control. Strength appears secondary to fabricability and quality.

Resins and Coaitngs for Corrugated Board. H. N. Johnston. *Tappi*, v. 43, March 1960, pp. 210A-213A.

Reviews the methods used in coating and treating corrugated board, and predicts future trends in research and development in this field. Suggests that such products as flame-retardant and vapor-phase-inhibitor coatings, flock-decorated containers, and coatings for carrying or duplicating messages to facilitate automatic handling of the container might all be in the future for the corrugated industry.

Factors Affecting the Rate of Deposition of Metals in Thermal Dissociation Processes. George H. Kesler. *Metallurgical Society of AIME, Transactions,* v. 218, April, 1960, pp. 197-202.

An expression is formulated for the rate of deposition of metal in a system wherein a heated deposition surface is immersed in continuously moving vapors of a compound of the depositing metal. The validity of the expression was established for pure cross-flow of titanium tetraiodide vapors past a titanium rod. Deviations can be explained by local variations in deposition rates around the rod, as shown by detailed calculations and by experimental rod cross sections.

Survey of Irradiation Facilities (First Addendum). J. F. Kircher and J. L. McFarling. PB 139 042-S-1; *REIC Report No.* 7 (Addendum), February 15, 1959, pp. 66. (LC mi $3.90 ph $10.80)

Contains a brief descriptions of reactor facilities completed in the past years, those under construction, and those in the planning stage. Additional gamma facilities are also listed.

Diffusion Rates and Solubilities of Interstitials in Refractory Metals. W. D. Klopp and Vincent D. Barth. PB 161 200; *DMIC Memorandum* 50, April 4, 1960, 66. 10. (OTS $0.50)

This report gives equations for diffusion rates of O,N,C, and H in Cb and Ta, and diffusion rates of N, C, H, and B in Mo and W. Solubilities of C, N, O, and H in W, Ta, Mo, Cb, V and Cr are also given.

Development of the Zone-Purification Process for Preparing Potable Water From Sea Water. W. H. Mink, G. F. Sachsel, and R. B. Filbert, Jr. PB 161 766. *Saline Water Research and Development Progress Report No.* 39; June 1, 1960, pp. 36. (OTS $1.00)

As a first step toward obtaining the optimum economic zone-freezing process, the vertical-tube unit was simulated on an analog computer to determine the effect of design parameters on product salinity. With this information plus some additional experimental freezing data, it was possible to show that the optimum vertical-tube unit would require four stages, would freeze 13% of the feed before discharging it, and would require that the temperature difference in the freezing zones be 3 F. For a plant designed to produce 10 million gallons of potable water per day, the total plant investment and the daily operating cost were estimated at about $115,000,000 and $4.24 per 1000 gallons, respectively.

The World Cobalt Situation. F. R. Morral. *Metals,* v. 31, no. 3, September, 1960, pp. 7-8.

Even if the worst imaginable (and now unforeseen) world events should cause world Co production to drop drastically for the next few years. U. S. has an abundant supply of this metal in surplus stocks and stockpiles to feed industry at its present rate. In the meantime, plants now closed in the U. S. and Canada could be reactivated. The Cuban and Congo crises offer world politicians much more genuine cause for concern than they do U. S. consumers of Co.

Selected References on Brittle Fracture. Don Owens and Lynne Doss. PB 161 205; *DMIC Memo* 55, May 5, 1960, pp. 65. (OTS $0.50)

The references are categorized and cross referenced as testing techniques; low-temperature fracture; fracture of welded structures; influence of processing variables other than welding; temper brittleness; hydrogen embrittlement; influence of composition on brittle fracture; ductile-to-brittle transition; stresss-corrosion cracking; fundamental studies and status of research; fracture of nonferrous materials; design considerations; case histories; and methods of circumventing brittle fracture.

Swelling of Reinforced Elastomers in Boiling Water. S. Palinchak and W. J. Mueller. *Rubber Age,* v. 87, no. 6, September, 1960, pp. 1020-1027.

This investigation has resulted in providing data that could be used in predicting more accurately the extended service life of a gasket or seal compound. Water absorption studies were conducted to help rubber technologists to equip steam and hot water systems. Data given on polymers and fillers point to impurities as the major bottleneck.

Chemical Surface Treatment of Titanium. H. A. Pray, P. D. Miller, and Richard A. Jefferys. PB 147 158, WAL 401/45-33, October 30, 1953, pp. 33. (LC mi $3.00, ph $6.30)

Two types of baths were developed that produce adherent, continuous coatings on Ti and its alloys: a 5% NaOH anodic bath, and fluoride-phosphate and fluorideborate immersion baths. The coatings minimize greatly the severe galling tendency of Ti. Certain treatments produced coatings that provided good service for various types of reciprocating and rotary wear. These treatments involved coating the Ti in an immersion bath to produce an adherent, continuous crystalline coating, followed by a heat treatment in air at about 800 F for 3 hours or by application of a MoS_2-Epon resin mixture. The wear resistance is comparable to that for carbonized or nitrided surfaces which require high-temperature treatments, resulting in damage to the core properties.

Simulation of Certain Industrial Systems With Small Electric Motors. (*In French.*) Considérations sur la simulation de certains systemes industriels par de petits moteurs electriques. Lucas Pun. *Automatisme,* v. 3, October, 1958, pp. 380-385; v. 3, December, 1958, pp. 461-468; v. 4, January, 1959, pp. 14-17.

Analyzes possible methods of simulation involving the use of amplitude frequency simulators, the physical nature of entrance an dexit signals, the static and dynamic characteristics of small electric motors, and techniques of their utilization. Discusses two instances of application: a nuclear reactor speed control simulator and a displacement simulator for aircraft motion.

The Determination of Oxygen, Nitrogen, Hydrogen, and Carbon in Molybdenum, Tungsten, Columbium, and Tantalum. Manley W. Mallett. PB 161 199, *DMIC Memo* 49, March 31, 1960, pp. 21. (OTS $0.50)

Oxygen is determined by neutron activation, fluorination, other halogenation, fractorgraphy, mass spectrometry, solid mass spectrometry, isotopic dilution, emission spectrometry, vacuum fusion, and inert-gas fusion; nitrogen by solution-distillation, alkali fusion, and other methods; and carbon by gravimetric, gasometric, and conductometric procedures.

The Use of Diffused Junctions in Silicon as Fast-Neutron Dosimeters. O. J. Mangali, E. Paskell, R. W. Beck, and C. S. Peet. Paper from *Proceedings of the Second Conference on Nuclear Radiation Effects on Semiconductor Devices, Materials and Circuits,* September 17th and 18th, 1959, Cowan Publishing Corp., New York. 1960, pp. 108-110 .

A silicon-diffused conductivity-modulated device has demonstrated its possible uses as a fast-neutron dosimeter in the tissue damage range. The stability of radiation-induced damage at room temperature and slightly above for conductivity-modulated devices increases the usefulness, as well as encourages the development of an economical and practical dosimeter.

The Influence of Lubrication on the Compactability of Magnesium-Green Salt Blends for Bomb Reduction. Stan J. Paprocki, Ronald J. Carlson, and Edward G. Smith, Jr. U. S. Atomic Energy Commission, BMI-1193, June 18, 1957, pp. 16. (OTS $0.30)

Thick lubricants such as mineral oil and Dag 217 were the most effective in preventing seizing over a period of time because they remained on the die surfaces longer than did the more fluid lubricants. When mineral oil was applied after every third press, 18 compacts could be pressed before seizing became severe; 78 compacts were pressed when Dag 217 was applied in the same way. Punch clearance was found to have little or no effect on the seizing problem itself; however, a slight taper at the bottom of the die cavity lessened the possibility of the punch becoming stuck during the compact-ejection step of the operation.

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

12940 Contract Research: Rewards and Frustrations. Monsanto tells the pros and cons of government contract research. Big incentive: early look at speculative research fields. *Chemical and Engineering News*, v. 38, no. 34, Aug. 22, 1960, p. 28 + 2 pages.

12941 Co-operation in the Field of Scientific and Technical Research. Discusses the necessity of organizing research on a national basis. Cites the United States as an example for European countries to follow. Not developed to the same extent in Europe as in the U. S. ***D. Wilgress.*** 27 pp. 1960. Organization for European Economic Co-operation, Paris. (Q180.A1 Or3c)

12942* The Inventing Process. Inducing the Spark. II. Explains methods of break-through when an incorrect pattern has been assumed. ***Hyman Olken.*** *Electromechanical Design*, v. 4, no. 8, Aug. 1960, p. 64-65.

12943* Research and Development. III. The Roots of the Product. The place R&D has in the product design and development of two companies selected for their very different, though equally design-oriented, products—Ampex Corporation, manufacturers of magnetic tape products, and Caloric Appliance Corporation, producers of gas ranges and other domestic gas products—is the subject of this third installment in ID's series on research, development and testing. ***Arthur Gregor.*** *Industrial Design*, v. 7, Aug. 1960, p. 52-61.

12944* Utilization Trends for Scientists and Engineers—Navy Style. In our Navy's management complex, the who-does-what factor can become critical. It boils down to the simple practicality that the officer should determine the what and the civilian should provide or create the how. Also considers new professional examinations and statistical projects now being conducted by the Navy. ***Arthur L. Sisson, Jr.*** *Journal of Industrial Engineering*, v. 11, no. 5, Sept.-Oct. 1960, p. 398-399.

12945 The Engineer in the Missile and Space Age. After a brief résumé of missile progress to date, the author, a committee chairman of NASA, stresses the responsibility of the engineer in proper decision making. ***William M. Holaday.*** *News in Engineering at Ohio State University*, v. 32, no. 3, July 1960, p. 3 + 6 pages.

12946* Age and Achievement—and the Technical Man. Reports results of one company's attempt to discover the relationship, if any, between age and achievement in its technical work force. Results were related to studies by Schaie and Lehman which suggested that technical work might be done best by men under 40. In research and development work, men under 40 had the highest performance rankings. In engineering work, this relationship was not found; performance improved steadily with age and experience up to and including the 56-60 age group. Although the conclusions and proposals listed are stated rather firmly and dogmatically, the author believes they should be treated as still in the unproved stage. More than anything else, this report should suggest to other organizations the possibility and desirability of carrying out similar research into the relation of age to productivity among its highly paid and highly important brain workers. ***Winston Oberg.*** *Personnel Psychology*, v. 13, no. 3, Autumn 1960, p. 245-259.

12947 Research Overhead and the Universities. Should government support of basic research in private universities cover overhead as well as direct costs? ***Norman Kaplan.*** *Science*, v. 132, Aug. 12, 1960, p. 400-404.

12948 How Design Research Pays Off. The consumer can tell you the area of his needs. The designer and engineer can come up with the solution to these needs. But many companies are still relying on past know-how, past materials, past and inadequate means of distribution. These companies, unless they change quickly, will be left far behind. *Steel*, v. 147, Sept. 19, 1960, p. 105-108.

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* Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

12949 System for Determination of the Parameters of the Motion of a Body in Space. The use of systems designed for Earth-bound flying objects on objects that move in interplanetary space entails difficulties due to the weightlessness of the sensitive elements of the accelerometers and the absence of suitable corrections. The method of double integration of the deviation between the reading of the system, referred to the position of an optical system aimed at the sun or some planet, from the actual position of the optical system, circumvents the foregoing difficulty and makes it possible to determine the parameters of motion in space. ***G. O. Fridlender.*** *ARS Journal*, v. 30, July 1960, p. 685-690.

12950 Ablation of Glassy Material Around Blunt Bodies of Revolution. The steady-state equations of motion for a thin layer of an incompressible glassy material on the surface of an ablating and radiating blunt body are reduced to a first-order ordinary differential equation which is integrated numerically. This solution is coupled with the solution of the air boundary layer for both laminar and turbulent heat transfer with or without mass vaporization of the ablating material. The distribution of the effective energy of ablation around the body is thus obtained for a cone cylinder with a hemispherical cap that reenters the atmosphere at hypersonic flight speeds, and has quartz as the ablating material. It is found that the ablation process from turbulent heating is more efficient than from the laminar case because of increased vaporization. This solution of the equations of motion at the stagnation point was verified by arc wind-tunnel experiments. The present state of development of the arc wind tunnel does not permit its use for experimental investigations of ablation around blunt bodies under turbulent heating. ***Henry Hidalgo.*** *ARS Journal*, v. 30, Sept. 1960, p. 806-814.

12951 Materials for Re-Entry Heat Protection of Satellites. Four types of materials suitable for ablation are discussed: a material which gasifies but does not liquefy; a material which reacts at its surface with the constituents of dissociated air; a material which melts and vaporizes; a material which partially gasifies, the remaining material being removed by surface combustion. The satellite re-entry environment was simulated in an electric arc-driven tunnel. Comparison is also made between results in low heat-transfer and high heat-transfer test environments to illustrate differences in behavior between steady-state and nonsteady-state ablation. On the basis of the analysis and experiments presented, it appears that little ablation of the materials considered will occur during the ballistic re-entry of a blunt nonlifting vehicle from a satellite orbit. The selection of materials for heat protection can, therefore, be strongly influenced by other criteria. ***Leo Steg.*** *ARS Journal*, v. 30, Sept. 1960, p. 815-822.

12952 Analysis of the Ablation of Plastic Heat Shields That Form a Charred Surface Layer. The model chosen for this type of ablation consists of a porous outer layer through which there is a counterflow of gases from the thermal decomposition of the plastic. The charred layer is backed by a semi-infinite layer of the undecomposed solid. The transpiring gases are considered to be in thermal equilibrium with the skeleton of the porous material. The heat-transfer equations are set up, and the steady-state solution obtained. The formulas for the steady-state temperature distributions, charred layer thickness, and heat of ablation in terms of model parameters and variables of the thermal environment are derived. An approximate formula is also derived for the induction time of the nonsteady phase of ablation. ***R. J. Barriault and J. Yos.*** *ARS Journal*, v. 30, Sept. 1960, p. 823-829.

12953 Supersonic-Wind-Tunnel Air-Drying-System Design. Examines various types of systems and presents a method of drying. ***T. W. Macios.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 277-281.

12954 Laminar Boundary Layers in Oscillatory Flow. The effects of free stream oscillations on laminar boundary layers of the Howarth type were studied. Detailed measurements of oscillations were made for the two conditions of Blasius flow and a Howarth flow fairly near separation. It was found that there are three types of behavior, corresponding to low, intermediate, and high frequencies. ***P. G. Hill and A. H. Stenning.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 3, Sept. 1960, p. 593-608.

12955 The Aerodynamics of Powered Flight. Mechanics of flight; introduction to aerodynamics; pressure distribution and lift, including lift analysis; boundary-layer effects; compressibility in subsonic flow; lift and drag variations; shock-wave analysis; wave combinations; thin-airfoil theory; sweepback and transonic effects; propeller analysis; airplane performance; maneuvering flight; elements of stability; test aids. ***Robert L. Carroll.*** 275 pp. 1960. John Wiley & Sons, New York. (TL570 C23a)

12956 Work-Horse of the Satellites. Discoverer XIII's successful orbit and re-entry capsule recovery establishes feasibility of space-capsule delivery from orbiting vehicles. Purpose of overall program is to test spectrum of basic satellite functions. ***Philip Geddes.*** *Aircraft and Missiles*, v. 3, Sept. 1960, p. 54-58.

12957* Auxiliary Systems . . . With Particular Reference to the Developments Towards System Integration in the British Aircraft Industry. Discusses the basic aircraft auxiliary system, including power converters, transmission and storage, output converters, and past and present trends in system development and integration. ***C. K. Trotman.*** *Aircraft Engineering*, v. 32, Sept. 1960, p. 246-254.

12958* Some Problems of Polar Missile Control. A polar-controlled missile is one in which maneuver is carried out by rotations about roll and pitch axes. In comparison with the alternative Cartesian configuration, this method presents some special design problems. ***D. Best.*** *Royal Aeronautical Society, Journal*, v. 64, Aug. 1960, p. 482-488.

12959* Engines for Supersonic Air Liners. Shows the effect of using different kinds of engines in the propulsion of a supersonic trans-Atlantic air liner at a variety of speeds. Discusses the interdependence of the engines and the airframe in the fields of aerodynamics, structures, installation, control, over-all performance and operation. ***R. R. Jamison and R. J. Lane.*** *Royal Aeronautical Society, Journal*, v. 64, Sept. 1960, p. 507-534.

12960 Selected Topics on Ballistics. Cranz Centenary Colloquium, University of Freiburg, Freiburg/Br., West Germany. Discusses 40 years of British aeroballistic research, exterior ballistics developments in the U. S., aerodynamic effects on long-range rocket craft, ballistics and launching of the Explorer I, meteorites and ballistics, projectile aeroballistics, the calculation of stability and damping of spin-stabilized projectiles, aspects of stability and controllability of cross-winged guided missiles, and the role of free flight ranges in ballistic and aerodynamic research. (*In French and English.*) ***Wilbur C. Nelson, editor.*** 280 pp. 1959. Pergamon Press, New York. (TL570 Ag15s)

12961 Vernier Engines for Control, Guidance, Acceleration, Braking. Discusses purpose, design, and use of vernier rockets; includes various types of fuel, location of verniers and fuel supplies, and their size. ***Kurt R. Stehling.*** *Space/Aeronautics*, v. 34, no. 2, Aug. 1960, p. 49-51.

12962 Sergeant and Its GSE: A Field System Good for 10 Years. The missile has four basic sections—forebody (warhead), guidance, solid-propellant rocket, and fin (control surface) assemblies; it weighs 10,000 lb and is 31 in. in diameter and 34½ ft long. Other major units of the system include missile section containers, launching station, organizational maintenance and field maintenance test station, transport semitrailers and gas-turbine generator sets, which supply primary power for all ground support operations. ***R. J. Parks, W. J. Schimandle, and Jack Davis.*** *Space/Aeronautics*, v. 34, no. 2, Aug. 1960, p. 52-57.

12963 Orbit Mechanics Holds Key to Space Flight. Outlines the present state of the art in designing and orbiting space vehicles and determining their trajectories. ***A. B. Mickelwait.*** *Space/Aeronautics*, v. 34, no. 2, Aug. 1960, p. 58-61.

12964 Which System for Propellant Level Sensing? Evaluates four systems that can be used for very close control of propellant level in liquid-fueled rockets. ***G. J. Friedman***

and Louis DeBottari. *Space/Aeronautics*, v. 34, no. 2, Aug. 1960, p. 103 + 6 pages.

AGRICULTURE

12965 Livestock-Production Plant of the Future. The farmstead of the future will take on the appearance of a plant or factory arranged and designed to produce efficiently one type of livestock or one kind of livestock product. ***H. J. Barre.*** *Agricultural Engineering*, v. 41, Sept. 1960, p. 619 + 3 pages.

12966 Costs and Benefits of Engineered Farmsteads. Discusses farmstead as a factor of production, direct costs of farm buildings, flexibility in farmstead planning, and long-term capital investments. ***V. W. Davis and R. N. Van Arsdall.*** *Agricultural Engineering*, v. 41, Sept. 1960, p. 622 + 6 pages.

12967* Bacterial Insecticides. A review. ***A. M. Heimpel and T. A. Angus.*** *Bacteriological Reviews*, v. 24, no. 3, Sept. 1960, p. 266-288.

12968* Analysis of a Highly Mutable Gene in Maize. A Molecular Model for Gene Instability. ***Drew Schwartz.*** *Genetics*, v. 45, no. 8, Aug. 1960, p. 1141-1152.

12969 Residue Analysis of a Chlorinated Insecticide (Thiodan) by Combination of Gas Chromatography and Infrared Spectrophotometry. A combination gas chromatography-infrared spectrophotometry technique is used to analyze quantitatively small traces of a chlorinated insecticide (Thiodan) extracted from plant materials. The advantages of this method are the relative simplicity, the possible application to other compounds, and the simultaneous qualitative and quantitative analyses of the compound under investigation. ***Gunter Zweig, T. E. Archer, and Daniel Rubenstein.*** *Journal of Agricultural and Food Chemistry*, v. 8, Sept.-Oct. 1960, p. 403-405.

12970* Developments in the Production of Mushroom Mycelium in Submerged Liquid Culture. Those species reported to have flavor are *Agaricus campestris, Morchella crassipes, Lepiota rachodes,* and *Corprinus comatus.* ***S. S. Block.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 3, Sept. 1960, p. 243-252.

12971* A Virus Disease of Coleoptera. (*In German.*) Über eine Viruskrankheit bei Coleopteren. ***Aloysius Krieg and Alois Huger.*** *Naturwissenschaften*, v. 47, no. 17, Sept. 1960, p. 403-404.

BIOCHEMISTRY AND BIOPHYSICS

12972 Advances in Biological and Medical Physics. ***Cornelius A. Tobias, John H. Lawrence, and Thomas L. Hayes, editors.*** v. VII. 362 pp. 1960. Academic Press, New York. (QH505 Ad95 Vis.)

12973 Amino Acids, Proteins and Cancer Biochemistry. Jesse P. Greenstein Memorial, ACS, Symposium held Sept. 16, 1959. ***John T. Edsall, editor.*** 244 pp. 1960. Academic Press, New York. (QP509 Am35.1a)

12974* An Agar Plate Assay for Anticancer Agents Utilizing Serially Cultured Sarcoma 180 (Foley). Best results were obtained using 0.5 x 10^6 cells/ml with a complete growth medium. Plates were incubated at 36 C. Resazurin was used as an indicator of cellular dehydrogenase activity. Ten compounds showed activity against sarcoma 180 (Foley) when this method was used. ***D. M. Schuurmans, D. T. Duncan, and B. H. Olson.*** *Antibiotics & Chemotherapy*, v. 10, Sept. 1960, p. 535-544.

12975* Potentiation in Combinations of Three Biochemically Related Antimetabolites. Combinations of sulfonamides and 2,4-diaminopyrimidines are strongly potentiative in the inhibition of the growth of *P. vulgaris* in vitro. The effects were studied of the addition of analogues of the purines and pyrimidines to such inhibited systems. The third component was considered potentiative only when it was capable of the displacement of more than an equi-inhibitory quantity of the sulfonamide-pyrimidine combination. ***Gertrude B. Elion, Samuel Singer, and George H. Hitchings.*** *Antibiotics & Chemotherapy*, v. 10, Sept. 1960, p. 556-564.

12976* Bibliography of Cancer Produced by Pure Chemical Compounds. A Survey of the Literature Up To and Including 1947. ***Otto Neubauer.*** 604 pp. 1959. Oxford University Press, London. (Z6664.C2 N39b Ref.)

12977* Demonstration of Cellular Uptake of Polymerized DNA in Mammalian Cell Cultures. Shows that when mammalian cells in culture are exposed to polymerized DNA, a small amount of intact DNA is taken up, and a smaller amount is degraded and the fragments incorporated into cellular DNA. ***Stanley M. Gartler and Olgerts R. Pavlovskis.*** *Biochemical and Biophysical Research Communications*, v. 3, no. 2, Aug. 1960, p. 127-131.

12978* Mutation as an Error in Base Pairing. Following the incorporation of some base analogues into DNA there is an increased likelihood of error in base pairing, the new stable pair at the mutant site being established only when two replications of DNA succeed the initial incorporation. ***Rivka Rudner.*** *Biochemical and Biophysical Research Communications*, v. 3, no. 3, Sept. 1960, p. 275-280.

12979* The Induction of Mutants of Bacteriophage T_2 by 5-Bromouracil. III. Nutritional and Structural Evidence Regarding Mutagenic Action. IV. Kinetics of Bromouracil-Induced Mutagenesis. ***Rose M. Litman and Arthur B. Pardee.*** *Biochimica et Biophysica Acta*, v. 42, no. 1, July 29, 1960, p. 117-140.

12980* On the Metabolic Stability of Nucleic Acids in Mitotically Inactive Adult Tissues Labeled During Embryonic Development. There was no loss of ^{14}C from the DNA purines of brain and liver, whereas the RNA of these tissues did lose radioactivity. ***L. L. Bennett, Jr., Linda Simpson, and Howard E. Skipper.*** *Biochimica et Biophysica Acta*, v. 42, no. 2, Aug. 12, 1960, p. 237-243.

12981* Febrile Response to Bacterial Pyrogens in Leukemia. The intravenous injection of 50,000,000 dead typhoid-paratyphoid bacilli produced a greater febrile reaction in non-leukemics than in patients with chronic lymphocytic leukemia. These results suggest that granulocytes may contribute to the production of the fever that follows injection of bacterial pyrogens. ***Abraham I. Braude, Jay Beck, and Margaret Zalesky.*** *Blood*, v. 16, Sept. 1960, p. 1279-1284.

12982 Comparative Biochemistry. I. Sources of Free Energy. A comprehensive treatise. ***Marcel Florkin and Howard S. Mason, editors.*** v. I. 590 pp. 1960. Academic Press, New York. (QP514 F66c)

12983* Chemical Protection of the Alimentary Tract of Whole-Body X-Irradiated Mice. I. Changes in Weight, Histology, and Cell Division in Relation to Nucleic Acid and Protein Synthesis. Chemical protection, by AET, of the alimentary tracts of mice against radiation doses of 900, 1500 and 2000 r was studied. For all measurements AET-treated mice were compared with nontreated mice and normal controls. All measurements demonstrated a marked protective action of AET on the alimentary tract at these radiation exposure doses. ***Jean R. Maisin, G. D. Novelli, D. G. Doherty, and C. C. Congdon.*** *International Journal of Radiation Biology*, v. 2, no. 3, July 1960, p. 281-293.

12984* Submerged Growth of Cells of Higher Plants. The submerged propagation of plant tissue and cell cultures has now reached the stage where mass amounts of material can be produced. Various aspects of the technology involved are discussed: the methods of isolation and establishment of cultures, the media used for culture and their effects on growth, the systems used for growth and a comparison of their effectiveness. ***Louis G. Nickell and Walter Tulecke.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 3, Sept. 1960, p. 287-297.

12985* Mass Propagation of Algae for Photosynthetic Gas Exchange. Intermediate and definitive level engineering studies to characterize algal systems—with a view to extrapolating to larger-scale systems for life support in closed spaces were conducted. Light intensity, carbon dioxide concentration, and

dilution rate were the principal parameters used to control the photosynthetic rate. Properly jacketed high-intensity, incandescent lamps provided a suitable light source for growing algae; and physiologically safe concentrations of carbon dioxide produced a satisfactory growth. ***Thomas A. Gaucher, Richard J. Benoit, and Adolph Bialecki.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 3, Sept. 1960, p. 339-359.

12986* Studies on the Mechanism of Action of Polynucleotide Phosphorylase. Polynucleotide phosphorylase catalyzes an exchange between guanosine 5′-diphosphate and inorganic orthophosphate-P^{32} at a rate similar to the analogous reactions with adenosine 5′-diphosphate and uridine 5′-diphosphate. ***Maxine F. Singer, Russell J. Hilmoe, and Marianne Grunberg-Manago.*** *Journal of Biological Chemistry*, v. 235, no. 9, Sept. 1960, p. 2705-2711.

12987* Genetic Influences on Iso-Immunization in the Rabbit. The production of iso-antibody is not simply a factor of donor-recipient incompatibility. Certain donor-recipient combinations, involving the same incompatible antigens, have different probabilities of antibody production. Antibody productivity may reflect the balance between compatible and incompatible units in an antigenic complex and the relative strength of the incompatible antigens. ***Carl Cohen.*** *Journal of Immunology*, v. 85, no. 2, Aug. 1960, p. 144-147.

12988 Mechanisms in Radiobiology. Multicellular Organisms. Discusses radiation effects on embryonic and adult organisms, chiefly in mammals. Devotes special chapters to immunological processes in irradiated organisms, to the mechanisms of action of protective and sensitizing agents, as well as the experimental possibilities of enhancing the recovery of irradiated mammals. ***Maurice Errera and Arne Forssberg, editors.*** v. II. 395 pp. 1960. Academic Press, New York. (QH652 Er78m)

12989* A Hybrid Helix Containing Both Deoxyribose and Ribose Polynucleotides and Its Relation to the Transfer of Information Between the Nucleic Acids. Presents evidence which shows that it is possible to have a hybrid helix in which one strand with a DNA backbone can be made to wrap around another strand with an RNA backbone in such a manner that the strands are held together by complementary H bonds formed between the purine and pyrimidine residues. ***Alexander Rich.*** *National Academy of Sciences, Proceedings*, v. 46, Aug. 1960, p. 1044-1053.

12990* Structure and Orientation of Free Radicals Formed by Ionizing Radiations in Certain Native Proteins. ***Walter Gordy and Howard Shields.*** *National Academy of Sciences, Proceedings*, v. 46, Aug. 1960, p. 1124-1136.

12991* Reconstitution of Complete Organs From Single-Cell Suspensions of Chick Embryos in Advanced Stages of Differentiation. Single-cell suspensions prepared from kidney, liver, or skin of 8-to-14-day chick embryos, scrambled, recompacted, transplanted to the chorio-allantoic membrane of eight-day embryos, and examined nine days later, proved to have been able to give rise to remarkably complete and morphologically well-organized organs of the respective kinds. ***Paul Weiss and A. C. Taylor.*** *National Academy of Sciences, Proceedings*, v. 46, Sept. 1960, p. 1177-1185.

12992* An Unidentified, Filtrable Agent Isolated From Transplanted Human Tumors. ***Helene W. Toolan, Gilbert Dalldorf, Marion Barclay, Satish Chandra, and Alice E. Moore.*** *National Academy of Sciences, Proceedings*, v. 46, Sept. 1960, p. 1256-1258.

12993 Mechanism of Formaldehyde-Induced Mutagenesis. The Uniqueness of Adenylic Acid in the Mediation of the Mutagenic Activity of Formaldehyde. ***Thomas Alderson.*** *Nature*, v. 187, Aug. 6, 1960, p. 485-489.

12994 Chromosomes and the Theory of Heredity. ***C. D. Darlington.*** *Nature*, v. 187, Sept. 10, 1960, p. 892-895.

12995 Water-Soluble, Non-Fibrous Deoxyribonucleoprotein From Calf Thymus Nuclei. A water-soluble, nonviscous form of deoxyribonucleoprotein was isolated from purified calf thymus nuclei by a process that minimizes enzyme degradation. Investigations lend further support to the view that the non-fibrous preparations are comprised of particles which are subunits of the conventional fibrous particles. ***Richard S. Welsh.*** *Nature*, v. 187, Sept. 10, 1960, p. 943-945.

12996* Chromosome Aberrations in Humans and Their Significance in the Formation of Deformities. (*In German.*) Chromosomenaberrationen beim Menschen und ihre Bedeutung für die Entstehung von Missbildungen. ***H. Nachtsheim.*** *Naturwissenschaften*, v. 47, no. 16, Aug. 1960, p. 361-371.

12997 Plant Physiology. v. IB. Photosynthesis and Chemosynthesis. ***F. C. Steward, editor.*** 348 pp. 1960. Academic Press, New York. (QK711 St49p)

12998 Medicine Consults the Design Engineer. Discusses replacement of organs, new gages and other new developments of devices in the field of medicine. ***Dora K. Merris, editor.*** *Product Engineering*, v. 31, no. 39, Sept. 19, 1960, p. 81-85.

12999 Progress in Biophysics and Biophysical Chemistry. Papers discuss the "high energy phosphate bond" concept, the structure and physical chemistry of nucleic acids and nucleoproteins, mechanisms for enzyme-catalyzed transfer reactions, O tension and oxidation-reduction potentials in living tissues, the configuration of proteins in solution, *in vitro* studies on the radiation biology of mammalian cells, thermodynamics and the interpretation of biological heat measurements, and other problems. ***J. A. V. Butler and B. Katz, editors.*** v. X. 440 pp. 1960. Pergamon Press, New York. (QH505 P94 Vis.)

13000* Evaluation of Tuberculosis Casefinding by Mass Small Film Radiography. Less than 10% of all new cases of tuberculosis discovered in 1958 were found by the radiographic screening method at an average cost of $1441 per case found. ***Andrew C. Fleck, Herman E. Hilleboe, and George E. Smith, Jr.*** *Public Health Reports*, v. 75, Sept. 1960, p. 805-813.

13001* The Pharmacology of Radioprotectant Chemicals. General Pharmacology of β-Mercaptoethylamine. When 100 mg of β-mercaptoethylamine (pH 7.0) is administered intravenously to the dog over a period of 5 min., a characteristic set of reactions is produced. The agent produces a delayed, severe, prolonged hypotension. MEA causes an immediate severe hypertenison in the dog pretreated with hexamethonium. This hypertension is probably due to discharge of epinephrine from the adrenal gland, since adrenalectomy prevents the reaction. The possibility is discussed that the physiological changes produced by this agent may contribute to its radioprotective potential. ***Roy L. Mundy and Melvin H. Heiffer.*** *Radiation Research*, v. 13, no. 3, Sept. 1960, p. 381-394.

13002 The Reticuloendothelial System in Antibody Formation. ***R. W. Wissler, F. W. Fitch, and M. F. LaVia.*** *U. S. Atomic Energy Commission, ACRH*-13, Mar. 1960, p. 39-51. (UF767 Un3.1ac Contin.)

13003 Studies on Antibody Production by Spleen Explants Maintained in Vitro. A maintenance tissue culture system was designed for the study of the spleen of rats given one intravenous dose of a particulate antigen. Antigen was synthesized as evidenced by a rise in antibody content in the tissue culture medium. This synthesis was accompanied by cellular differentiation similar to that described *in vivo* during antibody synthesis, but mitoses were not observed. ***M. F. La Via, S. A. Uriu, and L. A. Ferguson.*** *U. S. Atomic Energy Commission, ACRH*-13, Mar. 1960, p. 62-69. (UF767 Un3.1ac Contin.)

13004* Production of New Antigens in Phage-Infected Escherichia coli K12 (λ). Antisera prepared against crude extracts and fractions of *Escherichia coli* K12 (λ) infected with phage T4 were completely absorbed with extracts of uninfected K12 (λ). Results suggest that the residual activity in the serum absorbed with extracts of unifected bacteria and of phage is due to antibodies produced against new antigens, which are present in the infected cell but are not found in purified phage particles. ***C. A. Thomas, Jr. and S. R. Suskind.*** *Virology*, v. 12, no. 1, Sept. 1960, p. 1-7.

13005* A Curing Effect of Chloramphenicol on Bacteria Infected With Bacteriophage. Early addition of chloramphenicol to cells of *Salmonella typhimurium* infected with phage P22 results in curing a large proportion of the infected cells. The curing action is mutant strain specific: it is effective on wild-type phage P22 c^+ and on its virulent mutant c_2, but is much less effective on another virulent mutant c_1. ***Robert C-Y. Ting.*** *Virology*, v. 12, no. 1, Sept. 1960, p. 68-80.

13006* DNA-Content and UV-Radiation Resistance of *Lactobacillus leichmannii*. Cells of *Lactobacillus leichmannii*, more rich in DNA (grown on Vitamin B_{12}), are more resistant to UV-rays than those cells poorer in DNA (grown with guanine desoxyriboside). (*In German.*) DNS-Gehalt und UV-Strahlenresistenz von *Lb. leichmannii*. ***Wolfgang Eckart and Adolf Wacker.*** *Zeitschrift für Naturforschung*, v. 15b, July 1960, p. 429-430.

13007* On an Infectious DNA-Agent, Obtained From the φX 174 Bacteriophage. A DNA-agent has been obtained by phenol extraction of φX 174 bacteriophage. This DNA-agent is infectious for both *E. coli* C and *E. coli* B. Up to the present time, the participation of a protein component in the infective principle could be demonstrated neither by inactivation with φX 174 antiserum nor by digestion with proteases. (*In German.*) Über ein infektiöses Desoxyribonucleinsäure-Agens aus dem Phagen φX 174. ***P. H. Hofschneider.*** *Zeitschrift für Naturforschung*, v. 15b, July 1960, p. 441-444.

CERAMICS AND CONCRETE

13008 A Simplified Whitewares Control Test. A method for measurement of rate of filtration of clay or whiteware slips was simplified. The plastic properties of different clays or different lots of the same clay may be compared with a high degree of precision in a short period of time. Physical properties directly dependent upon these measurements include rate of casting, particle size or specific surface area, workability, and dry strength. ***Richard West.*** *American Ceramic Society Bulletin*, v. 39, Aug. 1960, p. 413-418.

13009 Casting Large Sections of Basic Refractories. A proposal to cast a bottom as a monolithic structure was evolved from extensive experiments in which large sections were cast successfully. ***Hobart M. Kraner, Ralph C. Padfield, and Richard E. Hauser.*** *American Ceramic Society Bulletin*, v. 39, Sept. 1960, p. 456-459.

13010 Casting of Ware With Highly Dispersed Clay Bodies. A high-intensity dispersion mill offers advantages in homogenizing plastic whiteware batches and improving their working properties for extruding and jiggering. The milling increases the viscosity of the slip by increasing the surface area of the clays which are used. ***Richard West and Leon Coffin.*** *American Ceramic Society Bulletin*, v. 39, Sept. 1960, p. 462-464.

13011 Basic Refractories for Open-Hearth Furnace Checkers. Discusses use of forsterite and magnesite bricks. Failure of basic checkers is associated with thermal fracture and, ultimately, disruption of the bricks. The characteristic cracking is considered to be a thermal fatigue phenomenon whereas the disruption is thought to be associated with changes in the constitution and distribution of the matrix. ***J. Hargreaves, J. R. Lakin, and J. Mackenzie.*** *British Ceramic Society, Transactions*, v. 59, July 1960, p. 260-283.

13012 Advancements in Technical Ceramics. Fused Silica for Missile Components. Describes techniques developed at Georgia Tech which allow fused silica to be fabricated into large and massive, or small and intricate, shapes at only a fraction of its previous cost, and with essentially none of the previous manufacturing difficulties. Applications include solid propellant rocket motor liners, nose cones, radomes and leading edges, as well as honeycomb stainless steel brazing fixtures and ceramic tooling. ***Jesse D. Walton.*** *Ceramic Age*, v. 76, no. 2, Aug. 1960, p. 33-38.

13013 Boeing Develops Self-Coating Ceramic. A graphite body consists by weight of 50% graphite, 24% $MoSi_2$ and 25% TiB_2, plus a small percentage of minor ingredients to promote bonding. This composite contains over 70% of graphite by volume and retains many of graphite's desirable properties. After cold-pressing to the desired shape, the ceramic is fired to nearly 3300° for about one hour in an inert atmosphere. When reheated in air for three hours at 2200°, the protective layer develops. In one composition, the layer appears as a smooth, adherent, nonporous, yellowish-brown film about 1/1000 in. thick. As temperature and exposure to oxidation increase, the layer thickens and becomes resistant. *Ceramic Industry*, v. 75, Aug. 1960, p. 72-73.

13014* Measurement of Coefficients of Cation Self-Diffusion in Silicate Melts by Means of the Radioisotopes Na^{24}, K^{42}, and Ca^{45}. The self-diffusion coefficients of the ions Na^+, K^+, and Ca^{++} in $Na_2O \cdot 2SiO_2$, $Na_2O \cdot Li_2O \cdot 4SiO_2$, $Na_2O \cdot K_2O \cdot 4SiO_2$, and $Na_2O \cdot CaO \cdot 4SiO_2$ melts were measured. (*In Russian.*) Izmerenie koeffitsientov samodiffuzii kationov v silikatnykh rasplavakh s pomoshch'iu radioaktivnykh izotopov Na^{24}, K^{42}, Ca^{45}. ***V. I. Malkin and B. M. Mogutnov.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 16 pp. (QC770 C76pr)

13015 Conditions of Glass Formation Among Simple Compounds. I. Conclusion. The conventional classification of the chemical binding forces into several types cannot be used to account for glass formation because, with the exception of true metals, all classes of substances can form glasses. Fluoride and nitrate glasses have ionic bonds. Most commercial glasses are of the so-called "mixed bond type". ***W. A. Weyl and E. C. Marboe.*** *Glass Industry*, v. 41, Sept. 1960, p. 487 + 6 pages.

13016 Silicones in the Fiber Glass Industry. One new application is the use of γ-aminopropyltriethoxysilane in conjunction with phenolic bonded glass wool batts which are used for thermal insulation. The latest development for silicones in the glass fiber industry concerns the Silrama Process, whereby decorative glass fabrics can be made with a wide variety of deep and rich colors. ***J. Sidlovsky.*** *Glass Industry*, v. 41, Sept. 1960, p. 499 + 3 pages.

13017 Glass. Its Industrial Applications. Manufacture, physical and chemical properties, and applications of all types of glass. Directed to the users—engineers, scientists, production and purchasing personnel—who are involved in the design, specification, testing, fabrication, purchase or sale of glass products. Reflects all the recent advances in the field and includes new information on such subjects as glass bead reflectorization and the "float glass" process for making flat glass. ***Charles John Phillips.*** 252 pp. 1960. Reinhold Publishing Corp., New York. (TP857 P54gL)

13018 Glass Technology Reports. Special Volume. Fifth International Congress on Glass. Control of glass quality; glass melting and forming processes; mechanical properties and behavior of glass; refractory corrosion and currents in glass-melting furnaces; physics and chemistry, structure, infrared transmission, history, and design of glass. Papers in German, French, or English. (*In German.*) Glastechnische Berichte. Sonderband. V. Internationaler Glaskongress. Sections individually paged. 1959. Druck von Carl Ritter & Co., Wiesbaden. (TP848 In8 Over.)

13019* A Few Remarks on the Causes Influencing the Operation of Brick Factory Kilns. The following causes among others may exert some effects on the firing process: products insufficiently dry when brought into the oven, method of stacking the products, grate arrangement in the fire boxes, length of the different zones, preheating, firing and cooling, draft control, quality and type of fuel used, and regularity of the fuel feeding process. (*In French.*) Quelques remarques sur les causes qui influencent la marche des fours de briqueterie. ***Lucien Welter.*** *Industrie Céramique*, 1960, no. 520, June, p. 209-211.

13020* Concerning the Iron-Cement Behavior. A study of the potential assumed by Fe placed in a cement medium. The variation of the electromotive force of nichrome cement calomel electrode as a function of time was examined. Stainless steel and drawn steel were also tested under similar conditions. (*In French.*) A propos du comportement fer-ciment. ***A. Nicol.*** *Revue des Matériaux de Construction*, 1960, no. 537, June, p. 149-156.

See also: **13590** (raw forsterite brick on low-volume furnaces).

CHEMICAL ENGINEERING

13021 Limiting Velocities, Holdup, and Pressure Drop at Flooding in Packed Extraction Columns. ***Gopal Venkataraman and G. S. Laddha.*** *A.I.Ch.E. Journal,* v. 6, no. 3, Sept. 1960, p. 355-358.

13022 Radiological Study of Liquid Holdup and Flow Distribution in Packed Gas-Absorption Columns. ***C. S. Hwa and R. B. Beckmann.*** *A.I.Ch.E. Journal,* v. 6, no. 3, Sept. 1960, p. 359-364.

13023 Comparison of the Specific Resistances of Cakes Formed in Filters and Centrifuges. ***V. V. Valleroy and J. O. Maloney.*** *A.I.Ch.E. Journal,* v. 6, no. 3, Sept. 1960, p. 382-390.

13024 Suspension of Slurries by Mechanical Mixers. When geometry and solids concentration are held constant, both phenomena are found to be controlled by similar dimensionless groupings of power per unit volume, density, and relative velocity between the fluid and particle. ***Joel Weisman and L. E. Efferding.*** *A.I.Ch.E. Journal,* v. 6, no. 3, Sept. 1960, p. 419-426.

13025 The Viscosity of Liquid Mixtures. This theory for liquid mixtures is based on Eyring's theory of absolute reaction rates. The most important conclusions drawn are that for liquids the free energies of activation for viscosity are additive on a number fraction or mole fraction basis and that interactions of like and unlike molecules must be considered. ***R. A. McAllister.*** *A.I.Ch.E. Journal,* v. 6, no. 3, Sept. 1960, p. 427-431.

13026 Influence Coefficients and Pressure Vessel Analysis. Advantages illustrated by two complex problems. The problems were: a cylinder closed by a torispherical head and a cylinder joined to a smaller cylinder by an ellipsoidal-toroidal shell. ***G. D. Galletly.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 82, no. 3, Aug. 1960, p. 259-269.

13027 Advances in Petroleum Chemistry and Refining. Contains economics of petrochemicals; liquid thermal diffusion; mechanism of hydrocarbon isomerization; and manufacture of petrochemical acetylene. ***John J. McKetta, Jr., editor.*** v. III. 544 pp. 1960. Interscience Publishers, New York. (TP690.A1 Ad95 Vis.)

13028* Fractionation of Fats, Oils, and Waxes on Thin Layers of Silicic Acid. Separation and identification of natural lipids by the technique of "thin-layer chromatography" is described. ***Helmut K. Mangold and Donald C. Malins.*** *American Oil Chemists' Society, Journal,* v. 37, Aug. 1960, p. 383-385.

13029* Flow Properties of Dry Particulates. ***E. J. Crosby.*** *American Perfumer and Aromatics,* v. 75, Sept. 1960, p. 43-48.

13030* Federal Research and Development Program for Saline-Water Conversion. ***Allen Cywin and Lewis S. Finch.*** *American Water Works Association, Journal,* v. 52, Aug. 1960, p. 983-992.

13031* Improved Solar Still Process for Desalting Sea and Brackish Waters. ***Werner N. Grune and Iraj Zandi.*** *American Water Works Association, Journal,* v. 52, Aug. 1960, p. 993-1005.

13032* Potential Application of Saline Water Conversion in Australia. Gives preliminary design and cost studies for multistage flash evaporation plants employing nuclear reactors as the heat source, both without and with concurrent power generation by means of back-pressure turbines. ***L. S. Herbert and H. R. C. Pratt.*** *Australasian Engineer,* v. 52, July 1960, p. 65-73.

13033* Determination of Vapour-Liquid Equilibria of Binary Mixtures. ***P. M. Heertjes.*** *Chemical & Process Engineering,* v. 41, Sept. 1960, p. 385-386.

13034 Generates Pure Hydrogen Right in Plant. Compact unit breaks down NH_3, then separates out H, gives small-volume user low-cost product on demand. Flowsheet of operation. *Chemical Engineering,* v. 67, Aug. 22, 1960, p. 54-55.

13035 Two Fresh Approaches to Pelletizing. Flowsheet of latest fertilizer plant where ammonium nitrate is prilled in efficient short tower, uses new spherodizer to simplify production of fertilizer pellets. *Chemical Engineering,* v. 67, Aug. 22, 1960, p. 106-109.

13036 Ion Exchange Becomes Powerful Processing Tool. Ion-exchange resins now handle both ionizable and nonionizable compounds in the areas of separation, recovery, concentration, catalysis and many types of synthesis. ***A. M. Seamster and R. M. Wheaton.*** *Chemical Engineering,* v. 67, Aug. 22, 1960, p. 115-120.

13037 Cryogenics Moves in on Methane. New, highly automated unit takes natural gas feed, flashes and fractionates it at low temperature to yield 99.99 + %-pure methane for making chlorinated hydrocarbons. *Chemical Engineering,* v. 67, Sept. 5, 1960, p. 98-101.

13038 New Idea in Jacketed Vessels. Reinforcing vessel with less-expensive steel jacket allows thinner alloy-steel inner wall. ***C. A. Feichtinger.*** *Chemical Engineering,* v. 67, Sept. 5, 1960, p. 127-130.

13039 Review Mass Transfer Concepts. Evaluation of a suitable potential difference for the driving force in mass transfer permits rational analysis of the equilibrium conditions. ***Jesse Coates and Bernard S. Pressburg.*** *Chemical Engineering,* v. 67, Sept. 5, 1960, p. 135-140.

13040* Optimization in Process Equipment Design. A critical survey of some methods and practices used for equipment design optimization with special emphasis on the use of digital computers. ***Jerry J. Taborek.*** *Chemical Engineering Progress,* v. 56, Aug. 1960, p. 37-41.

13041* Ultrahigh Pressure Technology. Synthesis of new materials having unique properties and the opportunity to explore geochemical and geophysical processes are becoming feasible with the rapid laboratory development of high pressures and temperatures. Pressure, as another degree of freedom, may be capable of producing new phases that do not undergo phase transitions at high temperatures. Development of improved high pressure and temperature apparatus means that geochemical processes and chemical synthesis are now open to exploration. ***C. M. Schwartz.*** *Chemical Engineering Progress,* v. 56, Aug. 1960, p. 71-76.

13042* Sweetening Liquid Hydrocarbons With Molecular Sieves. Details of a new commercial process. Operating data and cost estimate details show high promise. ***E. L. Clark, H. B. Rhodes, R. A. Raidt, and J. A. Lawrie.*** *Chemical Engineering Progress,* v. 56, Sept. 1960, p. 132 + 3 pages.

13043* Two-Phase (Gas/Liquid) Flow Phenomena II. Liquid Entrainment. Measurements were made of the entrainment of water droplets in an air-stream when air and water flow concurrently up a vertical glass tube. ***G. H. Anderson and B. G. Mantzouranis.*** *Chemical Engineering Science,* v. 12, no. 4, July 1960, p. 233-242.

13044 Chemical Processing Nomographs. Collection of 165 nomographs, which were published singly in various issues of *Chemical Processing.* A how-to-do-it book which gives practical working directions without theory. ***Dale S. Davis, editor.*** 255 pp. 1960. Chemical Publishing Co., New York. (QA90 D29cp)

13045* Optimum Temperature Pattern in a Reaction Tube. Frequently a quite definite temperature pattern leads to a maximum yield. The pattern can be evaluated in many cases only after considerable expenditure on numerical calculations. A reaction system is exhaustively examined. The IBM 705 electronic computer was used. (*In German.*) Über den optimalen Temperaturverlauf im Reaktionsrohr. ***F. Horn and U. Troltenier.*** *Chemie-Ingenieur-Technik,* v. 32, June 1960, p. 382-393.

13046* Investigation of Mass Transfer With Partial Condensation of Vapor Mixtures. The separating effect of a dephlegmator is decisively determined by the ratio of the condensate loading to the mass transfer coefficient. The effect can be precalculated for normal technical operating conditions if the mass transfer coefficient is known. Derivation of the mass transfer coefficient as a function of the substance parameters and the actual values for the instantaneous operating conditions are

given. (*In German.*) Untersuchungen zum Stoffübergang bei der Teilkondensation von Gemischdämpfen. ***Emil Kirschbaum and E. Tröster.*** *Chemie-Ingenieur-Technik*, v. 32, June 1960, p. 395-400.

13047* The Loadability of Laboratory Packed Columns. On the basis of theoretical formulae, it was possible with the aid of the Nusselt film-skin theory, to find a relationship for the permissible vapor velocity for mixtures flowing through the filling as a film. (*In German.*) Belastbarkeit von Laborfüllkörperkolonnen. ***R. Billet.*** *Chemie-Ingenieur-Technik*, v. 32, Aug. 1960, p. 544-550.

13048* Purification of Waste Waters From Superficial Treatment of Metals. Waste waters containing sodium bichromate are reduced either by ferrous sulfate or by sodium bisulfite or by sulfurous anhydride. (*In French.*) Épuration des eaux résiduaires du traitement superficiel des métaux. ***M. Dufournet.*** *Chimie & Industrie*, v. 84, no. 1, July 1960, p. 85-105.

13049 Gas Sterilization. Successful penetration of ethylene oxide mixture through plastic packaging films is the key. ***John J. Perkins.*** *Drug and Cosmetic Industry*, v. 87, no. 2, Aug. 1960, p. 178 + 6 pages.

13050 Catalysts for Acetylenes Removal From Gas Streams. Catalysts are compounded of precious metals on suitable supports. ***J. Gunther E. Cohn and Holger C. Andersen.*** *Engelhard Industries Technical Bulletin*, v. 1, no. 1, June 1960, p. 4-7.

13051 Handbook of Filtration. Emphasizes mechanisms of retention and filter paper permeability. Sections individually paged. 1960. The Eaton-Dikeman Company, Mt. Holly Springs, Pa. (TP156.F5 Ea83h)

13052 Heterogeneous Catalysis in the Petroleum Industry. Reviews major catalytic processes used in the petroleum and petrochemical industry. ***H. Pichler.*** *Institution of Chemical Engineering, Transactions*, v. 38, no. 4, 1960, p. 225-233.

13053* Highly Intensive Heat and Mass Transfer in Dispersed Media. Solves a system of differential equations for heat and mass transfer in a dispersed medium in the presence of phase conversions (the evaporation of liquid or steam condensation). ***Y. Mikhailov.*** *International Journal of Heat and Mass Transfer*, v. 1, no. 1, June 1960, p. 37-45.

13054* The Jewel Case. Brief account of synthetic diamond developments from late 1890's to the present. *Little (Arthur D.) Inc., Industrial Bulletin*, no. 376, June 1960, p. 1-2.

13055 Solvent Extraction of Mineral Acids. IV. Solute-Solvent Interaction in the System Perchloric Acid-Water-Tri-n-Butyl Phosphate. ***A. S. Kertes and V. Kertes.*** *Journal of Applied Chemistry*, v. 10, pt. 7, July 1960, p. 287-292.

13056* Ammonium Fluoride—Uranyl Fluoride—Water System. ***L. M. Ferris.*** *Journal of Chemical and Engineering Data*, v. 5, no. 3, July 1960, p. 241.

13057* Distribution Behavior of Neptunium and Plutonium Between Acid Solutions and Some Organic Extractants. ***Boyd Weaver and D. E. Horner.*** *Journal of Chemical and Engineering Data*, v. 5, no. 3, July 1960, p. 260-265.

13058* Ammonium Sulphate Manufacture Without the Use of Sulphuric Acid. Advantages of the Piritas Españolas Processs. *Nitrogen*, no. 7, Sept. 1960, p. 11-15.

13059 H-Oil Process Improves Quality of Distillate Feed. A new H-treating process mixes oil and H in an ebullating bed of catalyst. Good contacting of oil, H, and catalyst, and good lateral distribution of reactants result. ***M. C. Chervenak, et al.*** *Oil and Gas Journal*, v. 58, no. 35, Aug. 29, 1960, p. 80 + 5 pages.

13060 New Plastic Packing for Trickling Filters. Promises consistent removal of 99% of the phenol in waste waters at high loadings, effluent containing less than 0.5 p.p.m. sulfides, and no slime plugging. ***J. A. Porter and P. H. Dutch.*** *Oil and Gas Journal*, v. 58, no. 37, Sept. 12, 1960, p. 122 + 1 page.

13061* Distillation—In View of Modern Developments. II. Mathematics are applied to column design. ***Kenneth F. Gordon and James A. Davies.*** *Petroleum Engineer*, v. 32, Sept. 1960, p. C-40 + 3 pages.

13062* Principles of Unit Operations. A New, Unified Approach, Stressing Fundamentals Common to All Unit Operations. Presents operations as three unified groups stemming from identical fundamentals. The developments are built up from a simplified physical model or a basic mathematical relation, or both, using generalized notation. ***Alan S. Foust, Leonard A. Wenzel, Curtis W. Clump, Louis Maus, and L. Bryce Andersen.*** 578 pp. 1960. John Wiley & Sons, New York. (TP155 F82p Over.)

13063* Reactions of Organoaluminium Compounds. The Synthesis of Tetraethyllead From Triethylaluminium and Lead Acetate. (*In Polish.*) Reakcje związków glinoorganicznych. Synteza czteroethyloołowiu z trójetyloglinu i octanu ołowiawego. ***Włodzimierz Dahlig, Stanisław Pasynkiewicz, and Kazimierz Ważyński.*** *Przemysł Chemiczny*, v. 39, no. 7, July 1960, p. 436-438.

13064 The Effect of Filamentary Materials on Pressure-Vessel Design. ***George A. Hoffman.*** *Rand Corporation, Report* P-1974, Apr. 19, 1960, 21 pp. (T13 R15r Contin.)

13065 The Preparation of Uranium Dioxide From a Molten Salt Solution of Uranyl Chloride. Accomplishes reduction by contacting the salt solution with any of several metals, by reaction with H or dry NH_3, or by electrolysis. Several kg. of UO_2 were prepared by electrolysis using graphite electrodes. ***W. L. Lyon and E. E. Voiland.*** *U. S. Atomic Energy Commission, HW*-62431, Oct. 20, 1959, 20 pp. (UF767 Un3.1hw Contin.)

13066 The Performance of Base-Form Ion Exchangers for pH Control and Removal of Radioisotopes From a Pressurized Water Reactor System. ***G. P. Simon, C. S. Abrams, and W. T. Lindsay, Jr.*** *U. S. Atomic Energy Commission, WAPD-TM*-215, July 1960, 69 pp. (UF767 Un3.1wa Contin.)

13067 Controlling Mine Fires With High-Expansion Foam. Study shows that high-expansion foam containing at least 0.2 oz. of water per cu. ft. is effective in controlling experimental underground coal, oil, or wood fires. Ammonium lauryl sulfate is the foam agent of choice. ***John Nagy, Edwin M. Murphy, and Donald W. Mitchell.*** *U. S. Bureau of Mines Report of Investigations* 5632, 1960, 28 pp. (TN21 Un3r Room 290)

13068* Ion Exchangers in Modern Process Engineering. I. Ion Exchangers for Treating and Purifying Water. As a result of the low power consumption, particularly for treating very salty waters, there are other possible applications for electro-membrane dialysis. (*In German.*) Ionenaustauscher in der modernen Verfahrenstechnik. I. Ionenaustauscher zum Aufbereiten von Wasser. ***Kurt Heinrich.*** *VDI Zeitschrift*, v. 102, no. 22, Aug. 1, 1960, p. 1061-1067.

See also: **13346** (flow through orifices, nozzles, or venturi meters); **13386** (German coal chemistry); **13816** (uranium ore processing).

CHEMISTRY—ANALYTICAL

13069* Metallic Complexes of Anthranile-N,N-Diacetic Acid. (*In Rumanian.*) Complecşi metalici ai acidului antranil-n,n-diacetic. ***C. Drăgulescu, T. Simonescu, I. Menessy, and R. Anton.*** *Academia Republicii Populare Romine. Baza de Cercetări Ştiinţifice Timişoara. Studii şi Cercetări Ştiinţifice. Seria Ştiinţe Chimice*, v. 6, nos. 3-4, July-Dec. 1959, p. 9-19.

13070* Determination of Uranium by Chromatography. II. Determination by Column Chromatography. A method was evolved for the separation of U by column chromatography. The method can also be used in the case of minerals or ores which contain large amounts of Fe and V. The column consists of activated cellulose. ***T. Palágyi.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 22, no. 3, 1960, p. 239-245.

13071* Analysis of the Products of Nitration of Methane in the Gas Phase. Determination of Nitromethane in the Presence of Nitrite. Analysis of the complex mixture of products obtained on the nitration of methane in the gas phase with-

out any separation. Method is based on the quantitative conversion of nitromethane into nitrite and the subsequent determination of nitrite by photometry. ***János Giber and Tibor Meisel.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 22, no. 4, 1960, p. 435-441.

13072* The Detection and Determination of Diphenyl and *o*-Phenylphenol in Concentrated Orange Juice by Gas Chromatography. Compounds can be simultaneously determined in a 1-ml sample of juice by gas chromatography. The experimental error, at a probability of 95%, is ±0.4 p.p.m. for diphenyl and ±0.4 to −0.8 p.p.m. for *o*-phenylphenol, both compounds being present in concentrations between 1 and 10 p.p.m. ***R. Thomas.*** *Analyst*, v. 85, Aug. 1960, p. 551-556.

13073* Paper Chromatography of Some Organo-Tin Compounds. Paper partition chromatography of some organo-tin compounds, R_nSnX_{4-n} compounds, are detected by spraying with catechol violet after initial oxidation of compounds of the types R_4Sn and R_3SnX by ultraviolet irradiation, which renders them sensitive to the spray. ***D. J. Williams and J. W. Price.*** *Analyst*, v. 85, Aug. 1960, p. 579-582.

13074* Determination of Small Amounts of Chloride by Volhard Titration. Evaluation of Operator Determinate End-Point Error. Employ of the operator determinate end-point error has enabled determination of small amounts of chloride (0.00 to 0.090%) in ammonium nitrate, ammonium perchlorate, and potassium perchlorate with an average absolute error of 0.0004%, 0.0007%, and 0.0015%, respectively. ***Eugene A. Burns and R. F. Muraca.*** *Analytica Chimica Acta*, v. 23, no. 2, Aug. 1960, p. 136-144.

13075* Thorium Determinations With 8-Hydroxyquinaldine. Conditions that permit the quantitative precipitation of Th by 8-hydroxyquinaldine as the 1:4 chelate, with gravimetric and bromometric determinations of Th using this reagent, and with the merits of these. ***A. Corsini and R. P. Graham.*** *Analytica Chimica Acta*, v. 23, no. 3, Sept. 1960, p. 248-256.

13076* Radiochemical Separation of ^{95}Zr and ^{95}Nb With Tri-*n*-Butyl Phosphine Oxide. Separated efficiently by extraction with 0.005 *M* TBPO from 2*N* nitric acid solution. ^{95}Zr was extracted into the organic phase and ^{95}Nb remained in aqueous phase. Separation from hydrochloric acid solution was not possible. ***Hirokazu Umezawa and Reinosuke Hara.*** *Analytica Chimica Acta*, v. 23, no. 3, Sept. 1960, p. 267-270.

13077* The Direct Determination of Uranium in Concentrates by Spectrophotometric Titration With Ferric Sulphate. *T. M. Florence.* *Analytica Chimica Acta*, v. 23, no. 3, Sept. 1960, p. 282-288.

13078 Determination of Molybdenum in Nitrilotriacetic Acid Medium by Derivative Polarography. Application to Solutions of Mixed Thorium-Uranium Oxides. Major interferences include Cr(VI), Cu(II), Sn(IV), and Ni(II). ***D. L. Manning, R. G. Ball, and Oscar Menis.*** *Analytical Chemistry*, v. 32, Sept. 1960, p. 1247-1250.

13079 Automatic Coulometric Titrator. Application to the Determination of Sulfur in Petroleum by High Frequency Combustion. Coulometric titrator developed which relieves the analyst of titrating continually as the combustion proceeds. Titrant (iodine) is generated using from 0.2- to 5-second increments of constant current times to within 0.001 second. The generation of the titrant is controlled by amplified amperometric signals from a pair of detecting electrodes. ***John R. Glass and Edward J. Moore.*** *Analytical Chemistry*, v. 32, Sept. 1960, p. 1265-1269.

13080 Determination of Aromatic Aldehydes by Near-Infrared Spectrophotometry. Aromatic aldehydes have strong absorption bands in the 2.2-micron region. Quantitative applications are demonstrated by the determination of benzaldehyde in the presence of aromatic ketones and by the analysis of mixtures of nitrobenzaldehydes. ***R. M. Powers, J. L. Harper, and Han Tai.*** *Analytical Chemistry*, v. 32, Sept. 1960, p. 1287-1289.

13081 Molten Salt Mixtures as Liquid Phases in Gas Chromatography. New column for gas chromatography permits operation in the temperature range from 150 to over 400 C. Column packing material and tables showing the resolution on various types of organic compounds, particularly polyphenyls. ***Walter W. Hanneman, Charles F. Spencer, and Julian F. Johnson.*** *Analytical Chemistry*, v. 32, Oct. 1960, p. 1386-1388.

13082 Applications of Carbowax 400 in Gas Chromatography for Extreme Aromatic Selectivity. Selective retention of aromatic hydrocarbons relative to paraffinic hydrocarbons. Method developed for the determination of the aromatic content of aviation gasoline taking advantage of the selective retention of aromatics by Carbowax 400. ***Larry Randall Durrett.*** *Analytical Chemistry*, v. 32, Oct. 1960, p. 1393-1396.

13083 The Determination of Oxygen, Nitrogen, Hydrogen, and Carbon in Molybdenum, Tungsten, Columbium, and Tantalum. Presents a summary of information available to the Defense Metals Information Center, as of Jan., 1960. The determinations of the interstitials are most conveniently discussed when considered as to the interstitial element sought. ***Manley W. Mallett.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 49, Mar. 31, 1960, 16 pp. (TN799 B32.2d Contin.)

13084 New Uses for Gas-Liquid Chromatography in Plastics. Gas-liquid chromatography technique permits a greater control of raw materials and the examination of the structure of plastics. Provides a rapid and precise identification. ***W. H. Parriss and P. D. Holland.*** *British Plastics*, v. 33, Aug. 1960, p. 372-375.

13085 Mass Spectrophotometric Analysis of Gases in Metals. Method for analysis of gases in metals by which spectra of all components of a gaseous mixture are obtained even with volumes of gas too small for analysis by other procedures, the recording of the results being comparatively easy and continuous analysis a possibility. ***M. G. Bogolepov, R. N. Grigorash, and A. V. Panov.*** *Henry Brutcher Translation No.* 4805, 13 pp. + figures. (Translated from *Izvest. VUZ-Chern, Met.*, no. 1, Jan. 1960, p. 183-190. Henry Brutcher, Altadena, Calif.

13086* Quantitative Analysis of Pentaerythrol by X-Ray Transmission. New method of X-ray analysis based on the examination of the sample by transmission instead of by reflexion. Method has a general applicability, and is particularly indicated in the case of low-boiling mixtures and when the shortcomings connected with crystal orientation in the sample should be avoided. (*In Italian.*) Analisi quantitativa della pentaeritrite per via roentgenografica. ***Gianalvise Carazzolo.*** *Chimica e l'Industria*, v. 42, Aug. 1960, p. 858-863.

13087* Quantitative Macro- and Microdetermination of Traces of Cobalt. VII. Quantitative Microdetermination by Polarographic, Spectrometric and Neutron Activation Methods of Cobalt in a Cast. Comparative Study. (*In French.*) Macro- et microdosage de traces de cobalt. VII. Microdosage polarographique, spectrophotométrique et par activation aux neutrons, du cobalt dans une fonte. Etude comparative. ***J. Vogel, D. Monnier, and W. Haerdi.*** *Helvetica Chimica Acta*, v. 43, no. 5, 1960, p. 1254-1267.

13088* Quantitative Inorganic Chromatography. V. The Separation and Determination of Ferrous and Ferric Iron. Anion-exchange technique was used to determine the minor constituent in mixtures of Fe(II) and Fe(III) iron in ratios between 1:100 and 40:1 respectively. ***F. H. Pollard, J. F. W. McOmie, G. Nickless and P. Hanson.*** *Journal of Chromatography*, v. 4, no. 2, Aug. 1960, p. 108-116.

13089* Chloranilic Acid as a Reagent in the Paper Chromatography of Inorganic Compounds.. I. Alkali and Alkaline Earth Metals. Using a 0.1% ether solution of chloranilic acid and the dipping technique rather than spraying, it is possible to detect 0.2-1 μg of Na, K, and Li and 0.5-5 μg of Ba, Ca, Sr, and Mg. ***H. S. R. Barreto and R. C. R. Barreto.*** *Journal of Chromatography*, v. 4, no. 2, Aug. 1960, p. 153-155.

13090* Complexometric Titration of Thorium Using Some Azo Dyes From Chromotropic Acid. Direct and rapid determination of Th with ethylenediamine tetracetic acid dyes formed colored chelates with Th in slightly acid medium which are decomposed by the addition of EDTA, the Th complex of which is more stable than those of the dyes, showing marked color change at the end-point. ***Sachindra Kumar Datta.*** *Journal of Scientific & Industrial Research*, v. 19B, May 1960, p. 168-170.

13091* Paper Chromatographic Separation of Silver, Lead & Mercurous Mercury Metals. Qualitative separation and identification using 0.2*N* sulfuric acid and ammonium nitrate-ammonia mixture. ***V. K. Mohan Rao.*** *Journal of Scientific & Industrial Reseach*, v. 19B, May 1960, p. 171-173.

13092* Applications and Limitations of Turbidimetric Titration as a Method of Characterizing Solutions of Polymers and Mixtures of Polymers. The validity of turbidimetric titration in the analysis of polymer mixtures was tested using mixtures of known composition. In some cases, which included three out of four mixtures of block or graft copolymers with homopolymers, the method was not even semiquantitative. ***P. E. M. Allen, R. Hardy, J. R. Majer, and P. Molyneux.*** *Makromolekulare Chemie*, v. 39, nos. 1-2, July 1960, p. 52-66.

13093 Spectrophotometric Determination of Titanium in High-Temperature Alloys. Titanium is separated as hydroxide, and interference due to Mo, Cr, and Fe is eliminated. After dissolution of the hydroxide, hydrogen peroxide is added and the optical density of the solution is determined spectrophotometrically. ***N. M. Silverstone and B. B. Bach.*** *Metallurgia*, v. 62, Aug. 1960, p. 81-82.

13094 Differential Thermal Analysis. Applications of differential thermal analysis to the study of the chemistry and properties of plastics are reviewed. DTA is rapid and the thermograms provide significant information regarding the chemical and physical characteristics of the polymers. ***C. B. Murphy.*** *Modern Plastics*, v. 37, no. 12, Aug. 1960, p. 125 + 6 pages.

13095 Spectroscopic Investigation of the Hydrogen Bond in Acid Silicates and Phosphates. Infrared absorption spectra were obtained for the acid silicates $Ca_2(SiO_3OH)OH$ and $Ca_2(SiO_3OD)OD$ and the acid phosphates K_2HPO_4, K_2DPO_4, $K_2HPO_4 \cdot 3H_2O$, $BaHPO_4$ and $BaDPO_4$. The frequencies of the planar deformation vibrations δOH of the O_3SiOH and O_3POH ions were established. ***Ya. I. Ryskin and G. P. Stavitskaya.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 8, no. 5, May 1960, p. 320-324.

13096* Infrared Analysis of Butadiene Polymers. Procedure developed in which pure calibration substances are not needed; notably this new procedure is better adapted to the spectroscopic behavior of rubbery polymers than are the currently used methods. ***W. Kimmer and E. O. Schmalz.*** *Rubber Chemistry and Technology*, v. 33, no. 3, July-Sept. 1960, p. 639-651. (Translated from *Zeitschrift für Analytische Chemie*, v. 170, 1959, p. 132-147.)

13097 Concerning a Method for the Spectrographic Lead Determination in Gasoline by Means of X-Ray Fluorescence. By adding an excess of ethylene bromide to gasoline and by interpreting the relationship of the radiation intensities due to Pb and Br, it is possible to lessen the disturbances caused in the determination of Pb in fuels by X-ray spectrography by the varying densities and contents of Br and S, so that by applying one calibration curve for all kinds of gasoline the same accuracy is obtained as with the standardized ASTM method. (*In German.*) Über eine Methode zur röntgenfluoreszenz-spektrographischen Bleibestimmung in Benzin. ***H. Preis and A. Esenwein.*** *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 26, Aug. 1960, p. 317-320.

13098 Systematic Analysis of Surface-Active Agents. Classification, detection, isolation, estimation, qualitative analysis, quantitative analysis, and separation of mixtures of surface-active agents. ***Milton J. Rosen and Henry A. Goldsmith.*** v. XII. 422 pp. 1960. Interscience Publishers, New York. (QD271 R72s)

13099 Solubility and Distribution Study of Antimony, Tantalum, Niobium, Ruthenium, Tungsten, and Titanium. Solubilities and extractions under conditions existing in the Weldon Spring uranium refinery. Maximum amounts of these elements that would be expected to report in the uranium trioxide are, in most cases, orders of magnitude below 1 ppm. ***S. D. Nelson and G. P. Lang.*** *U. S. Atomic Energy Commission, MCW-1453*, July 29, 1960, 11 pp. (UF767 Un3.1mc Contin.)

13100 Methods for Analyzing Titanium Metal for Tin. Chemical, optical emission spectrochemical, and X-ray spectrographic methods. Of the two chemical methods studied, the iron reduction method is superior in both time required for an analysis and in the detection limit, and the precision is quite satisfactory for the concentration and impurity range studied. ***T. A. Sullivan, R. W. Lewis, L. Carpenter, and B. J. Boyle.*** *U. S. Bureau of Mines Report of Investigations* 5639, 1960, 14 pp. (TN21 Un3r Room 290)

13101* The Applicability of the Omegatron to Continuous Analysis of Residual Gases. Analysis was continuous before, during and after both ion pumping with a Bayard-Alpert pattern hot-cathode gage and the dispersal of a barium getter. Results are more extensive than any published hitherto and are presented both as mass spectra and the variation of gas constitution with time throughout each stage of the above operations. ***Franklin A. Baker and Tiziano A. Giorgi.*** *Vacuum*, v. 10, nos. 1-2, Feb.-Apr. 1960, p. 58-63.

13102* 8-Hydroxyquinoline and 8-Hydroxyquinaldine as Reagents for the Colorimetric Estimation of Chromium. Method developed for the extraction of chromium (III) oxinate from the reaction mixture in the presence of the mother-liquor itself and subsequently, the colorimetric estimation of the extracted solution is carried out at 425 nm. ***J. P. Tandon and R. C. Mehrotra.*** *Zeitschrift für Analytische Chemie*, v. 176, no. 2, 1960, p. 87-90.

13103* Nicotinamidoxime as an Analytical Reagent. III. Polarographic Studies on the Nature of the Nickel Complex and Spectrophotometric Determination of the Metal. ***K. K. Tripathi and D. Banerjea.*** *Zeitschrift für Analytische Chemie*, v. 176, no. 2, 1960, p. 91-96.

13104* The Si K β-Emission Bands of the X-Ray Spectra of Elementary Silicon, Silicon Carbide and Silicon Dioxide. A comparison of the emissions, together with that from diamond, indicates that the spectra essentially represent the form of the energy bands of the valency electrons and that they are little influenced by unusual excited states. The emission bands of silicon, carborundum and diamond show to a great extent similar features, thereby indicating an essentially covalent type of bonding in all cases including carborundum. (*In German.*) Die Si K β-Banden der Röntgenemissionsspektren von elementarem Silicium, Siliciumcarbid und Siliciumdioxyd. ***B. Kern.*** *Zeitschrift für Physik*, v. 159, no. 2, 1960, p. 178-193.

13105* Spectrographic Determination of Impurities in Iridium and Rhodium. Gives a method for the spectrographic analysis of Ir and Rh for admixtures of 12 elements. (*In Russian.*) Spektral'nyi metod opredeleniia primesei v iridii i rodii. ***A. A. Kuranov, V. D. Ponomareva, and N. I. Chentsova.*** *Zhurnal Analiticheskoĭ Khimii*, v. 15, no. 4, Aug. 1960, p. 476-480.

CHEMISTRY—INORGANIC AND GENERAL

13106 The Chemistry of Sulfur Tetrafluoride. IV. Fluorination of Inorganic Oxides and Sulfides. Sulfur tetrafluoride is a versatile, easily handled fluorinating agent useful in the preparation of a wide range of inorganic fluorides by replacement of oxygen or sulfur in inorganic compounds. ***A. L. Oppegard, W. C. Smith, E. L. Muetterties, and V. A. Engelhardt.*** *American Chemical Society, Journal*, v. 82, Aug. 5, 1960, p. 3835-3838.

13107 The Compressibilities of Certain Molten Alkali Silicates and Borates. Measurements lend support to a model of the liquids containing SiO_2 "iceburgs" at low M_2O content and discrete Si or B containing oxy-anions at high M_2O concentrations. ***J. O'M. Bockris and E. Kojonen.*** *American Chemical Society, Journal*, v. 82, Sept. 5, 1960, p. 4493-4497.

13108 The Reaction of Nitric Oxide With Triethyl Phosphite. Liquid phase reaction, $2NO + (EtO)_3P \rightarrow N_2O + (EtO)_3PO$ reaction is first order in nitric oxide and first order in phosphite, and the reaction rate is quite insensitive to the nature of the solvent. A reaction mechanism is proposed. ***Lester P. Kuhn, J. Omar Doali, and Carl Wellman.*** *American Chemical Society, Journal*, v. 82, Sept. 20, 1960, p. 4792-4794.

13109 Phosphates of Cadmium. Regions of stability of the various basic phosphates of Cd including cadmium ammonium phosphates and their solid-state reactions and products obtained on pyrolysis. ***R. C. Ropp and R. W. Mooney.*** *American Chemical Society, Journal,* v. 82, Sept. 20, 1960, p. 4848-4852.

13110 Metal Dithizone Complexes of Mercury and Cobalt. The complex of dithizone formed with Co in the presence of air was found to contain three dithizone residues to one cobalt atom. In the dithizone complexes of Hg, Cu, and Co(III) there is very little H bonding in carbon tetrachloride solution. ***J. F. Duncan and F. G. Thomas.*** *Chemical Society, Journal,* 1960, July, p. 2814-2824.

13111 Iodine Oxygen Compounds. II. Iodosyl and Related Compounds. Preparation and infrared and visible spectra of iodosyl sulphate, iodosyl selenate, iodine dioxide, and μ-oxo-dinitratodiphenyldi-iodine. ***W. E. Dasent and T. C. Waddington.*** *Chemical Society, Journal,* 1960, Aug., p. 3350-3356.

13112 Crystals and the Polarising Microscope. Comprehensive treatment both of use and applications of the polarizing microscope and of underlying principles. ***N. H. Hartshorne and A. Stuart.*** 3rd Ed. 557 pp. 1960. Edward Arnold Ltd., London. (QD941 H25c3)

13113 Graphite and Its Crystal Compounds. Survey of studies on both the physical properties and the chemistry of graphite. Describes relationships of graphite with its crystal compounds, with diamond, and other carbons that are structurally more complex and chemically less pure. ***A. R. Ubbelohde and F. A. Lewis.*** 217 pp. 1960. Oxford University Press, London. (QD181.C1 Ub1g)

13114 Atomic and Molecular Hydrogen Yields From Irradiated Acids. Paramagnetic-resonance was used to measure the yields of atomic hydrogen from many concentrations of aqueous sulfuric, phosphoric, and perchloric acids at 77 K after irradiation with γ rays. ***Ralph Livingston and A. J. Weinberger.*** *Journal of Chemical Physics,* v. 33, Aug. 1960, p. 499-508.

13115 Reactions of Group Vb Chlorides With Boron Trichloride and Gallium Trichloride. New procedures were developed for the synthesis of $PCl_5 \cdot BCl_3$, a knowledge of which allows an interpretation to be made concerning its mode of formation. ***R. R. Holmes.*** *Journal of Inorganic and Nuclear Chemistry,* v. 14, nos. 3-4, Aug. 1960, p. 179-183.

13116 The Reaction of Ethylene With Tetraborane: The Preparation, Structure and Properties of Dimethylenetetraborane. Chemical and physical evidence indicate that this new compound has a cyclic bridge structure which is unique in borane chemistry. ***B. C. Harrison, I. J. Solomon, R. D. Hites, and M. J. Klein.*** *Journal of Inorganic and Nuclear Chemistry,* v. 14, nos. 3-4, Aug. 1960, p. 195-201.

13117 The Reaction Between Lithium Hydride and Rhodium to Form a Hydryl. Hypothesis is proposed that Li, Rh, and H can combine to form a new type of hydrogen compound, a "hydryl" compound, which is analogous to the known carbonyl and cyanyl compounds. ***J. D. Farr.*** *Journal of Inorganic and Nuclear Chemistry,* v. 14, nos. 3-4, Aug. 1960, p. 202-207.

13118 Preparation of Uranous Oxalate. Feasibility of producing a high-purity uranous oxalate free of halides and sulfates. A practical method was found for preparing this compound. ***L. R. Phillips, C. D. Hardin, W. L. Harper, and C. D. Montgomery.*** *U. S. Atomic Energy Commission,* Y-1308, July 7, 1959 (Issued Aug. 23, 1960), 18 pp. (UF767 Un3.1y Contin.)

13119* Equilibrium Measurements in the System Iridium-Oxygen—Gaseous Iridium Trioxide. Equilibrium measurements by means of the carrier gas method show that heated iridium and iridium dioxide are volatilized in currents of O or O-N under formation of gaseous iridium trioxide, IrO_3, being stable up to 1700 C. (*In German.*) Gleichgewichtsmessungen im System Iridium–Sauerstoff Gasförmiges Iridiumtrioxyd. ***Harald Schäfer and Hans-Joachim Heitland.*** *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 304, nos. 5-6, June 1960, p. 249-265.

13120* On Vanadates. I. Colorimetric Studies on Orange Vanadates. Colorimetric studies of the systems metavanadate-acid indicate the formation of the same hexacondensed orange vanadate ion $(HV_6O_{17})^{3-}$. ***Apurba Kumar Sen Gupta.*** *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 304, nos. 5-6, June 1960, p. 328-336.

13121* Oxidation of Titanium Diboride. The oxidation process of TiB_2 in O_2-atmosphere was measured in the temperature range of 700-1100 C on very pure samples, prepared by reaction from the gas phase. The scale isotherms are parabolic in the temperature range of 700 to 850 C and of 950 to 1100 C, but they are following a third power low at 900 C. (*In German.*) Über die Oxydation des Titandiborids. ***A. Münster and G. Schlamp.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 25, nos. 1-2, July 1960, p. 116-129.

See also: **13044** (chemical processing nomographs).

CHEMISTRY—ORGANIC

13122 Advances in Organic Chemistry. Methods and Results. Discusses alkenylmagnesium halides, dialkoxydihydrofurans and diacyloxydihydrofurans, ethynyl ethers and thioethers as synthetic intermediates, ketene in organic synthesis, nuclear magnetic resonance in organic structural elucidation, hydrogenation-dehydrogenation reactions, ultraviolet photochemistry of simple unsaturated systems, and muscarine. ***Ralph A. Raphael, Edward C. Taylor, and Hans Wynberg, editors.*** v. II. 504 pp. 1960. Interscience Publishers, New York. (QD241 Ad95 Vis.)

13123 Chemistry of the Metal Carbonyls. III. The Reaction Between Iron Pentacarbonyl and Tetraorganotin Compounds. ***R. B. King and F. G. A. Stone.*** *American Chemical Society, Journal,* v. 82, Aug. 5, 1960, p. 3833-3835.

13124 Arylboronic Acids. VI. Aminoboronic Anhydrides and a New Heterocycle Containing Boron. Reports new tetracyclic boron-containing heterocycle. Discusses the structure of the compound, an *o*-methylene-bridged dihydrobenzoboradiazole, and some of its properties. ***Richard T. Hawkins and H. R. Snyder.*** *American Chemical Society, Journal,* v. 82, Aug. 5, 1960, p. 3863-3866.

13125 Synthesis of Organoboranes. Preparation of aryl- and alkyldihaloboranes from aromatic and olefinic hydrocarbons, trialkylboranes from alkyl halides and alkyldiboranes from alkyl halides and H. In all cases aluminum metal and BCl_3 or $B(OR)_3$ are the other reagents. ***E. L. Muetterties.*** *American Chemical Society, Journal,* v. 82, Aug. 20, 1960, p. 4163-4166.

13126 The Reaction of Styryl Radicals With Organoaluminum Compounds. Chain transfer constants of organoaluminum compounds with the styryl radical transfer constants were found to be unusually large. The mechanism appears to be one of radical exchange between the whole group attached to the aluminum atom and the attacking styryl radical. ***Terry Huff and Eli Perry.*** *American Chemical Society, Journal,* v. 82, Aug. 20, 1960, p. 4277-4281.

13127 Synthesis and Reactions of 3,4-Epoxycyclopentene. Epoxide of cyclopentadiene synthesized by reaction of cyclopentadiene and peracetic acid in an inert solvent in the presence of anhydrous sodium carbonate. This reactive epoxide is easily hydrolyzed to a mixture of 1,2- and 1,3-cyclopentenediols. ***Malcolm Korach, Donald R. Nielsen, and Walker H. Rideout.*** *American Chemical Society, Journal,* v. 82, Aug. 20, 1960, p. 4328-4330.

13128 The Radiation-Induced Chain Alkylation of Ethylene With Propane. Gas phase reaction studied in static experiments. Irradiations were done at two levels of intensity corresponding to energy absorption rates of 17 x 10^6 and 48 x 10^6 rad/hr. *G* values exceeding 100 molecules of ethylene reacted per 100 ev establish the chain nature of the reaction. ***W. Bartok and P. J. Lucchesi.*** *American Chemical Society, Journal,* v. 82, Sept. 5, 1960, p. 4525-4528.

13129 Monomers and Polymers Containing Si-O-As Linkages. Preparation and characterization of monomers and polymers containing Si-O-As(III) or Si-O-As(V) linkages. ***Bertrand L. Chamberland and Alan G. MacDiarmid.*** *American Chemical Society, Journal,* v. 82, Sept. 5, 1960, p. 4542-4546.

13130 Synthesis of Monoesters of Phosphonic Acids. Dialkyl esters of aryl- and alkylphosphonic acids can be hydrolyzed smoothly, rapidly, and in high yield by refluxing in aqueous or ethanolic alkali. ***Robert Rabinowitz.*** *American Chemical Society, Journal,* v. 82, Sept. 5, 1960, p. 4564-4567.

13131 Effect of Borate on the Alkali-Catalyzed Isomerization of Sugars. Borate appears to increase both the rate of formation and the maximum amount of ketose formed. ***Joseph F. Mendicino.*** *American Chemical Society, Journal,* v. 82, Sept. 20, 1960, p. 4975-4979.

13132* Thermal Dimerization of Fatty Ester Hydroperoxides. Dimeric products were isolated from autoxidized fats and methyl esters and from purified fatty hydroperoxides after complete decomposition of the hydroperoxides at 210 C in an inert atmosphere. ***E. N. Frankel, C. D. Evans, and J. C. Cowan.*** *American Oil Chemists' Society, Journal,* v. 37, Sept. 1960, p. 418-424.

13133 Esterification of Fatty Acids With Diazomethane on a Small Scale. Routine procedure for esterifying milligram amounts of fatty acids by CH_2N_2. The esterification mixture, after adjustment to the desired concentration or solvent, is ready for gas-liquid chromatography or paper chromatography. ***Hermann Schlenk and Joanne L. Gellerman.*** *Analytical Chemistry,* v. 32, Oct. 1960, p. 1412-1414.

13134* New Preparation Methods in Organic Chemistry. III. Syntheses Using Diazoketones. Includes unpublished investigations leading from aliphates via carbohydrates and peptides to isocyclic and heterocyclic compounds. The various materials dealt with show the great range of application of diazoketones as a means for syntheses. Since alpha-diazoketones are extraordinarily reactive, an increase of knowledge in the field of preparative and theoretical organic chemistry can still be expected. (*In German.*) Neuere präparative Methoden der organischen Chemie. III. Synthesen unter Verwendung von Diazoketonen. ***F. Weygand and H. J. Bestmann.*** *Angewandte Chemie,* v. 72, no. 16, Aug. 21, 1960, p. 535-554.

13135* Organo Arsenic Compounds. I. N,N-Dialkyl Amidodichloroarsenites and N-Alkyl Imidochloroarsenites. II. N,N-Dialkyl Amidodifluoroarsenites and N-Alkyl Imidofluoroarsenites. ***George A. Olah and Alexis A. Oswald.*** *Canadian Journal of Chemistry,* v. 38, Sept. 1960, p. 1428-1433.

13136 Organotin Compounds. Organotin compounds of two- and four-covalent tin, analysis, physiological properties, and industrial applications of organotin compounds. 924 references provide the data for this review. ***Robert K. Ingham, Sanders D. Rosenberg, and Henry Gilman.*** *Chemical Reviews,* v. 60, no. 5, Oct. 1960, p. 459-539.

13137 The Preparation of Some Cobaltic Porphyrin Complexes. Cobaltichromes are non-ionic and contain coordinated nitrogenous bases; the second type of complex contains the Co in the cation, and the third type contains the Co in the anion. ***A. W. Johnson and I. T. Kay.*** *Chemical Society Journal,* 1960, July, p. 2979-2983.

13138 Organometallic Compounds of Group II. II. Alkylation of Aromatic Hydrocarbons by Use of Magnesium and Alkyl Halides. ***D. Bryce-Smith and W. J. Owen.*** *Chemical Society, Journal,* 1960, Aug., p. 3319-3324.

13139 Radiation Chemistry of Carbohydrates. V. The Effect of Ultraviolet Light on Aqueous Solutions of D-Glucose in Oxygen. D-Glucose is degraded when irradiated in aqueous solution with ultraviolet light. Degradation is examined by measuring the changes in acidity, optical rotation, and ultraviolet absorption spectra. ***G. O. Phillips and G. J. Moody.*** *Chemical Society, Journal,* 1960, Aug., p. 3398-3404.

13140* Synthesis of Dyes With the Neocyanine Structure Presented by Brooker, and Related Dyes. III. Condensation of 3-Ethyl-2-Methylbenzothiazolium Iodide and Nitrosobenzene, and the Dyes Obtained From Its Condensates. IV. Structure of the Dyes Obtained by the Condensation of 3-Ethyl-2-Methylbenzothiazolium Iodide With Nitrone or Anil Derivatives. V. Synthesis of the Brooker-Type Dyes From the Anil of 3-Ethyl-2-Formylbenzothiazolium Iodide. ***Shiro Kimura.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 7, July 1960, p. 872-881.

13141* Studies on Seven-Membered Heterocyclic Compounds Containing Nitrogen. IV. Hexahydro-1,2,5-Triazazulene. V. 2,3,4,5-Tetrahydro-1(H)-indolo[2,3-c]azepine. VI. 7-Methyl-2,3,4,5-tetrahydro-1(H)-thiazolo[5,4-c]azepine. IV-V. ***Shiro Morosawa.*** VI. ***Akira Yokoo and Shiro Morosawa.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 8, Aug. 1960, p. 1108-1119.

13142* Method of Obtaining Sulfur-Labeled Compounds by Reaction of "Hot" Sulfur-35 Atoms With Cyclic Hydrocarbons. Method is based on the exposure in a nuclear reactor of hydrocarbon mixtures to carbon tetrachloride, with subsequent separation of the labeled products by means of the stable carrier technique. The role of the hot exchange and of the radiation effects are explained. The types of reactions characteristic for the hot sulfur atoms, and the yields of these reactions were determined, as well as the balance in the active sulfur, the high reaction capacity of the hot sulfur atoms, and the practical absence, in the system, of the typical product of the reactions of hot S atoms. Up to 98% sulfur is spent in the formation of sulfur organic compounds as a result of the introduction of S in C-C and C-H bonds, in the substitution of the CH_2-group, in the destruction of the cyclic molecule and of the compounds with its fragments, and in the polymerization of the sulfur atoms. (*In Russian.*) Poluchenie mechennykh po sere soedinenii v rezul'tate reaktsii goriachikh atomov sery-35 s tsiklicheskimi uglevodordami. ***B. G. Dzantiev and I. M. Barkalov.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 22 pp. (QC770 C76pr)

13143* Snythesis of Tritium-Labeled Cyclic Hydrocarbons by Using Tritium Recoil Nuclei. Studies the effects of "hot" atoms of tritium on cyclohexane, cyclohexene, methyl cyclohexane, cyclohexanol, cyclohexyl amine, benzene and cyclohexadienes. Discusses the mechanism of stabilization of the hot tritium atoms. Cyclic tritium-labelled compounds can be obtained in satisfactory amount by the "hot" synthesis. Shows the absence of isotope exchange in cyclohexanol-cyclohexane, cyclohexane-methyl cyclohexane systems, and the slow exchange in the tritium-cyclohexanol system. (*In Russian.*) Sintez mechenykh po tritiiu tsiklicheskikh uglevodorodov s pomishch'iu iader otdachi tritiia. ***A. N. Nesmeianov, B. G. Dzantiev, V. V. Pozdeev, and Iu. M. Rumiantsev.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 17 pp. (QC770 C76pr)

13144* Studies on the Leuco-Compounds of Anthraquinone Series. II. Kinetics of Isomerisation of Anthranol to Anthrone. Preparation of pure anthranol and a study of the methods of measuring the velocity constants of isomerization of anthranol to anthrone by analytical and dielectrical technics. (*In Japanese.*) ***Yoshié Bansho and Kenkichi Nukada.*** *Government Chemical Industrial Research Institute, Tokyo, Reports,* v. 55, July 1960, p. 230-234.

13145 Pinonic Acid—A Promising Chemical Raw Material. Versatile compound has potentialities for: plant hormones; mercerizing penetrants; synthetic lubricants; plasticizers; amino and dibasic acids; and polyesters. ***Glen W. Hedrick and Ray V. Lawrence.*** *Industrial and Engineering Chemistry,* v. 52, Oct. 1960, p. 853-856.

13146 Instability Constants of Complex Compounds. Tables give the instability constants of 1381 complex compounds, from data published up to 1954, and in some cases up to 1955-56. An additional table gives the enthalpy, free energy, and entropy changes for a number of complex-formation reactions, together with appropriate references. ***K. B. Yatsimirskii and V. P. Vasil'ev.*** 217 pp. 1960. Pergamon Press, New York. (QD471 Ia8ktr)

13147 Organic Semiconductors. II. The Electrical Resistivity of Organic Molecular Complexes. Thirty molecular complexes involving quinones, halogens, polynitroaromatics, or tetracyanoethylene as electron acceptors and aromatic hydrocarbons or substituted aromatics as electron donors were prepared and the room temperature electrical resistivities measured on compressed microcrystalline material. ***Mortimer M. Labes, Robert Sehr, and Monisha Bose.*** *Journal of Chemical Physics,* v. 33, Sept. 1960, p. 868-872.

13148 Synthesis of Some 5- and 6-Chloro, 5-Methyl, and 5,6,7-Trimethyl Derivatives of Tryptamine. The preparation of 5-chloro-*N,N*-dimethyl-, 6-chloro-*N,N*-dimethyl-, and 6-chlorotryptamine from the corresponding ring-chlorinated indoles was carried out. Discusses a nine-step synthesis of 5,6,7,*N,N*-pentamethyltryptamine from 3,4,5-trimethylacetophenone and the preparation of 5,*N,N*-trimethyltryptamine from 5-methylindole. These compounds were prepared for psychopharmacological evaluation. ***F. Benington, R. D. Morin, and L. C. Clark, Jr.*** *Journal of Organic Chemistry,* v. 25, Sept. 1960, p. 1542-1547.

13149 Synthesis of Potential Anticancer Agents. III. Nitrogen Mustards Derived From 8-Aminoquinolines. IV. Synthesis of Certain Substituted Amino- and Aziridinopyrimidines. III. ***Robert C. Elderfield and Ernest F. LeVon.*** IV. ***Robert C. Elderfield and Raj Nandan Prasad.*** *Journal of Organic Chemistry,* v. 25, Sept. 1960, p. 1576-1590.

13150 Chlorinated Aromatic Silicates and Related Compounds. Twelve chlorinated aromatic silicates were synthesized from phenols with either chlorosilanes or ethyl orthosilicate, and from sodium phenates and silicon tetrachloride. ***P. D. George and Arthur E. Newkirk.*** *Journal of Organic Chemistry,* v. 25, Sept. 1960, p. 1645-1648.

13151 Preparation and Properties of Some Trialkylboranes. Triethyl-, tri-*n*-propyl-, and tri-*n*-butylborane were prepared and fractionated under an inert atmosphere to prevent oxidation. Triethylborane and tri-*n*-propylborane were obtained in purities of 99.8 and 99.7 mol.%, respectively, while tri-*n*-butylborane underwent thermal decomposition during distillation. ***Louis Rosenblum.*** *Journal of Organic Chemistry,* v. 25, Sept. 1960, p. 1652-1655.

13152* Synthesis of Dicarboxylic Acids by Direct Oxidation of Liquid Paraffins by Oxygen of the Air. At a hydrolysis temperature of 150-180° the amount of separated water soluble acids reaches the maximum. A further raise of the temperature causes a decrease of the yield of dicarboxylic acids, because of their decomposition. The quality of dicarboxylic acids separated at a higher temperature is higher by the other number and by the content of crystalline acids. The dicarboxylic acids consisted of a mixture of crystalline and noncrystalline acids. (*In Russian.*) Sintez dikarbonovykh kislot priamym okisleniem zhidkikh parafinov kislorodom vozdukha. ***V. K. Tsyskovskiĭ, M. I. Levina, B. G. Freĭdin, and V. P. Leont'eva.*** *Khimicheskaia Promyshlennost',* 1960, no. 4, June, p. 8-11.

13153 A New Method for the Synthesis of Cyclic Ethers. General synthesis of oxetanes which is a direct and cheap process giving fair yields. ***L. F. Schmoyer and L. C. Case.*** *Nature,* v. 187, Aug. 13, 1960, p. 592-593.

13154 A Molecular Complex of Benzene and Hexafluorobenzene. Investigation of the freezing points, obtained from cooling curves, of mixtures of known composition of benzene and hexafluorobenzene. ***C. R. Patrick and G. S. Prosser.*** *Nature,* v. 187, Sept. 17, 1960, p. 1021.

13155* Chemistry of Acetylenic Ethers. XLII. A Simplified Method for the Preparation of Acetylenic Thioethers; a Number of New Reactions of These Compounds. XLIII. Reactions of Oximes With Ethoxyethyne. XLII. ***H. J. Boonstra and J. F. Arens.*** XLIII. ***H. D. A. Tigchelaar-Lutjeboer, H. Bootsma, and J. F. Arens.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 79, Aug. 1960, p. 866-894.

13156 The Cracking of *Cyclo*pentene on a Silica-Alumina Catalyst. Cracking studied in a flow system over the temperature range 368 to 505 C. Analysis of products carried out by gas-liquid chromatographic techniques and the design of the apparatus made it possible to measure the pressures of compounds of low molecular weight at a series of points along the catalyst bed. ***C. Kemball and J. J. Rooney.*** *Royal Society, Proceedings,* v. 257, ser. A, Aug. 23, 1960, p. 132-145.

13157* Study of the Thermolysis of Some Pure Hydrocarbides. The thermolysis of butene-1, hexene-1, heptene-1, octene-1, cyclohexene and phenylcyclohexane was carried out in the absence and in the presence of contact substances, under normal, and under high pressure, at different temperatures. The products obtained were analyzed and an attempt was made to explain the formation of the compounds. (*In French.*) Étude de la thermolyse de quelques hydrocarbures purs. ***Lucien Golder.*** *Société Chimique de France, Bulletin,* 1960, no. 6, June, p. 1067-1071.

13158 Soviet Research on Organo-Phosphorus Compounds, 1949-1956. Inorganic complexes of organic compounds of P; phosphines, phosphine oxides, phosphonium compounds, and their Se, N, S and halogen derivatives; and N-containing derivatives of organic phosphorous compounds are discussed. 1208 pp. 1960. Consultants Bureau, Inc., New York. (QD412.P1 C76s)

13159* Tables for Identificaton of Organic Compounds. Supplement to "Handbook of Chemistry and Physics". Compilation consisting of more than 4380 parent compounds, and brings together for the first time such a large quantity of data directly applicable to qualitative organic analysis. ***Charles D. Hodgman, et al, editors.*** 241 pp. 1960. Chemical Rubber Publishing Co., Cleveland. (QD291 H66t Ref.)

13160* Free-Radical Reactions Involving Sulphur Compounds. III. Photolysis of Aromatic Disulphides. Dimesityl disulfide proved to be a particular suitable model compound for investigating the photo-dissociation reaction of aromatic disulfides. Rate constants were found to decrease with increasing kinematic viscosity of the solvent. ***Y. Schaafsma, A. F. Bickel, and E. C. Kooyman.*** *Tetrahedron,* v. 10, nos. 1-2, July 1960, p. 76-80.

13161* Reduction of Organic Compounds by Lithium in Low Molecular Weight Amines. Highly Selective Lithium-Amine Reducing Systems. Greater selectivity can be achieved in reducing aromatic compounds selectively to mono-olefins by carrying out the reactions in a mixture of solvents rather than in the pure amine. ***Robert A. Benkeser, Ram K. Agnihotri, and Merwyn L. Burrous.*** *Tetrahedron Letters,* 1960, no. 16, July, p. 1-3.

13162* Ionization and Dissociation Equilibria of Some Triphenylchloromethane Derivatives in Nitrobenzene at 25°. ***E. Price and N. N. Lichtin.*** *Tetrahedron Letters,* 1960, no. 18, Aug., p. 10-16.

13163* Reduction of Carbon Dioxide in Aqueous Solutions Under the Influence of Radiation. Effect of ^{60}Co-γ-rays on CO_2 in aqueous solutions under various conditions can lead initially to the formation of formaldehyde, acetaldehyde and formic acid. There are indications that oxalic and glycol are also formed, particularly after higher doses or radiation. ***N. Getoff, G. Scholes, and J. Weiss.*** *Tetrahedron Letters,* 1960, no. 18, Aug., p. 17-23.

13164* The Synthesis of Two Dihydropentalenyl Derivatives. ***A. Modiano and M. Cais.*** *Tetrahedron Letters,* 1960, no. 18, Aug., p. 31-35.

13165* Reation of Aromatic Alcohols With Phosphorous Pentasulfide. Primary alcohols and some of the secondary alcohols bearing aryl and alkyl groups yielded O, O-diaralkyl hydrogen phosphorodithioates as primary product and these acid esters decomposed easily by heat to give hydrogen sulfide, mercaptans, thioethers and unsaturated hydrocarbons, while the secondary alcohols containing only aryl groups and tertiary alcohols gave only unsaturated hydrocarbons. ***Taro Yamasaki.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy,* v. 12, no. 3, June 1960, p. 252-257.

13166* Tautomerism of 2-Hydroxy-1,3-diazaazulene. 2-Hydroxy-1,3-diazaazulene, obtained by hydrolysis of 2-amino- or 2-mercapto-1,3-diazaazulene with hydrochloric acid, is considered to be present in the so-called lactim-lactam type tautomers. ***Ichiro Murata.*** *Tôhoku University, Science Reports*

of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy, v. 12, no. 3, June 1960, p. 271-279.

13167 Some Factors Correlating the Rates of Gas Formation in the Radiolysis of Aromatic Hydrocarbons. Logarithms of the relative yields of gas produced by the action of ionizing radiation on the purely aromatic hydrocarbons were found to be inversely proportional to the ionization potential and excitation energies; directly proportional to the conjugation energies and number of pi electrons in the molecules. ***J. G. Burr and J. D. Strong.*** *U. S. Atomic Energy Commission, NAA-SR-4962*, July 15, 1960, 8 pp. (UF767 Un3.1na Contin.)

13168 Gamma Irradiation of Hexafluorobenzene. Mixtures of hexafluorobenzene and benzene were irradiated in liquid phase by means of a Co^{60} gamma source at 20 and at 218 C. Perfluoroheptane and various binary mixtures involving perfluoroheptane, hexafluorobenzene, benzene, and cyclohexane were also irradiated at 20 C. ***R. E. Florin, L. A. Wall, and D. W. Brown.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry*, v. 64A, no. 4, July-Aug. 1960, p. 269-280.

13169* Simplified Methods of the Synthesis of Glycerides. Methods of direct esterification simplified the synthesis of glycerides. These methods are equal to indirect procedures employing blocking groups and that they are applicable to the preparation of labile glycerides such as α,β-diglycerides. (*In Polish.*) Uproszczone metody syntezy glicerydów. ***L. Hartman.*** *Wiadomosci Chemiczne*, v. 14, July 1960, p. 425-432.

13170* Studies in the Chemical Behaviour of Sulphur Compounds. X. Piperidine Thiosulphate. Sulfur dissolved in the piperidine gives an intense red solution which undergoes oxidation by the atmospheric O to form a precipitate which contains piperidine thiosulfate and a small amount of piperidine sulfite and sulfate. Mechanism of reaction is proposed to explain the oxidation. ***K. Sharada and A. R. Vasudeva Murthy.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 304, nos. 5-6, June 1960, p. 344-350.

CHEMISTRY—PHYSICAL

13171* On the Stability of Ozonides. Thermal decomposition in benzene of three ozonides was studied iodometrically. Activation energies were calculated. ***Erling Bernatek and Mette Hvatum.*** *Acta Chemica Scandinavica*, v. 14, no. 4, 1960, p. 836-840.

13172* Contact Conversions of Some Haloid-Alkyls. Studies the contact decomposition of 2-chloropropane and a series of alkyl bromides in the presence of the catalysts α-Fe,Fe_2O_3, Fe_2O_3-Cr_2O_3(1:1). The formation of halogen halide and of unsaturated hydrocarbons is the basic direction taken by the decompoistion of haloid alkyls; the passage of N-C_3H_7Br to C_4H_9Br does not change the direction of the process but occurs at different temperatures between 200 and 400 C with a varying percentage of decomposition. (*In Russian.*) Kontaknye prevrashcheniia nekotorykh galoidalkilov. ***A. A. Balandin, A. I. Kukina, I. P. Baryshnikova, and V. N. Ermakova.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 7, July, p. 1162-1169.

13173 The Activity of Raney Nickel as a Function of Hydrogen Content. Surface area of Raney nickel and its activtiy for ethylene hydrogenation and parahydrogen conversion as a function of hydrogen content. ***R. J. Kokes and P. H. Emmett.*** *American Chemical Society, Journal*, v. 82, Sept. 5, 1960, p. 4497-4501.

13174* On the Mechanism of the Extraction of Uranyl Nitrate by Tributyl Phosphate. II. Infrared Study. Infrared study concerning the mechanism of extraction. Gives discussions for the systems TBP-water, TBP-nitric acid and TBP-uranyl nitrate individually, and presents the extraction mechanism of the system TBP-uranyl nitrate-nitric acid. ***Kenkichi Nukada, Keiji Naito, and Utako Maeda.*** *Chemical Society of Japan, Bulletin*, v. 33, no. 7, July 1960, p. 894-898.

13175* Study of the Carbon Isotope Exchange Reactions Between Potassium Cyanide and Some Carbonates, and Their Use for Obtaining C^{14}-Labelled Potassium Cyanide. The isotope exchange of carbon between KCN and the carbonates of Li, Na, K, Ba was studied. The exchange in the KCN-$BaCO_3$ system begins at 650 C and is complete at 800 C in two hours. The exchange in the KCN-M_2CO_3 systems (where M is Li, Na, K) begins at 550 C and reaches 100% for Li_2CO_3 at 550 C, and for Na and K at 700 C. The speed constants of the reaction of the isotope exchange were determined and calculation was made of the value of the apparent energy of activation, which for the KCN - $BaCO_3$ system corresponds to ~45 kcal/mol, and for the KCN - Na_2CO_3 systems to ~32 kcal/mol. The conditions to obtain C^{14}-labelled potassium cyanide by the isotope exchange method with subsequent precipitation of potassium cyanide from the carbonate of the extractions by liquid ammonia were determined. Labeled potassium cyanide was obtained with more than 90% yield and with a content of the basic substance higher than 96%. (*In Russian.*) Izuchenie reaktsiĭ izotopnogo obmena ugleroda mezhdu tsianistym kaliem i karbonatami i primenenie ikh dlia polucheniia tsianistogo kaliia mechennogo izotopom C^{14}. ***O. I. Andreeva and G. I. Kostikova.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 18 pp. (QC770 C76pr)

13176* Study of the Isotope Effect in Hydrogen Exchange Reactions in Liquid Hydrogen Bromide and Liquid Ammonia. The coefficients of the equilibrium distribution of deuterium and tritium in benzene-liquid ammonia and naphthalene-liquid hydrogen bromide systems were measured. The values of the coefficients found for the tritium exchange were equal to dNT_3 $C_6H_6 = 0.63$, $dTBr-C_{10}H_8 = 3.8 - 4.2$. Calculation was made of the coefficients d_D and d_T by the methods of statistical thermodynamics using approximate values of the vibration frequencies computed by the authors. The exchange involving hydrogen bromide agreed satisfactorily with the experimental data. The kinetic isotope effects in the liquid phase systems ammonia-benzene (in the presence of potassium amide as a catalyst) and hydrogen bromide-diphenyl were determined. (*In Russian.*) Issledovanie izotopnykh effektov pri reaktsiiakh vodorodnogo obmena v zhidkom bromistom vodorode i zhidkom ammiake. ***I. F. Tupitsyn, N. K. Semenova, and G. I. Avduloe.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 22 pp. (QC770 C76pr)

13177* Study With Radio-Sulfur of the Kinetics of the Process $SO_2 + 0.5\ O_2 \rightleftarrows SO_3$ in a State of Chemical Equilibrium on a Platinum Catalyst. Tracer atoms were used in measuring the speed of direct and reverse reactions of oxidation of SO_2 on a Pt grid as a function of the concentration of SO_2 and SO_3 at different temperatures. The molar ratio of the process was found to be 1:1. The experimental data agreed with the equations. (*In Russian.*) Issledovanie pri pomoshchi radioaktivnoĭ sery kinetiki protsessa $SO_2 + 0.5\ O_2 \rightleftarrows SO_3$ nakhodiashchegosia v sostoianii khimicheskogo ravnovesiia, na platinovom katalizatore. ***V. A. Roĭter, N. A. Stukanovskaia, and G. P. Korneĭchuk.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 19 pp. (QC770 C76pr)

13178 Frozen Free Radicals. Discusses the early history, experimental methods, basic principles and requirements of trapping, studies of individual atoms, diatomic and triatomic radicals, and polyatomic radicals containing C. ***G. J. Minkoff.*** 148 pp. 1960. Interscience Publishers, New York. (QD471 M66f)

13179 Heat and Thermodynamics. Theoretical and experimental account of the science of heat and thermodynamics in its present state. The applications of thermodynamics to physics, engineering, and physical chemistry are discussed analytically, and in relation to experimental data. Applications of the quantum theory, phase transitions, and low-temperature phenomena are considered. ***J. K. Roberts and A. R. Miller.*** 5th

Ed. 619 pp. 1960. Interscience Publishers, New York. (QC 254 R54h5)

13180* Kinetics of Oxidation of Alcohols by Chromic Acid—The Mechanism of the Reaction. Analysis of the various factors affecting the oxidation of secondary alcohols shows the following features. The formation of an ester of chromic acid is not essential to oxidation. Both structural and solvent influences from the study of a series of secondary alcohols, aliphatic as well as aromatic, suggest that in the rate-determining step of the reaction, the C-H hydrogen is removed as a hydride ion. The rate-determining step involves a two-electron transfer and the reacting species can be hexavalent and pentavalent chromium. ***S. V. Anantakrishnan and N. Venkatasubramanian.*** *Indian Academy of Sciences, Proceedings*, v. 51, sec. A, no. 6, June 1960, p. 310-318.

13181* Thermodynamic Properties of Dichlorotetrafluoroethane. Experimental data over wide ranges of temperature and pressure, and appropriate correlating equations developed to permit calculation of the thermodynamic properties of the saturated liquid, saturated vapor, and superheated vapor of dichlorotetrafluoroethane. ***Joseph J. Martin.*** *Journal of Chemical and Engineering Data*, v. 5, no. 3, July 1960, p. 334-336.

13182* Hydrogen Cyanide Stability and Heat of Polymerization. Effects of temperature, sodium hydroxide, water, hydrogen cyanide polymer, and "weathered" hydrogen cyanide on the length of time that hydrogen cyanide can be held without violent polymerization; and the effect of the relative amount of hydrogen cyanide in a container on the incubation time. ***E. H. Gause and P. D. Montgomery.*** *Journal of Chemical and Engineering Data*, v. 5, no. 3, July 1960, p. 351-354.

13183 Molecular Structure of Lithium Chloride Dimer. Thermodynamic Functions of Li_2X_2 (X = Cl, Br, I). Electron diffraction investigation of dimeric lithium chloride. This system affords a definite advantage since the concentration of dimers exceeds that of the monomers by several fold, under conditions suitable for electron diffraction. ***S. H. Bauer, Tadashi Ino, and Richard F. Porter.*** *Journal of Chemical Physics*, v. 33, Sept. 1960, p. 685-691.

13184 Effects of Pressure on Dielectric Relaxation in a Chlorinated Diphenyl. Properties of Aroclor 1260, over a wide range of frequencies and temperatures, and also over a range of pressures up to 200 kg/cm^2 at four fixed temperatures from 17 to 51 C. ***Thomas A. Perls and L. Bruce Wilner.*** *Journal of Chemical Physics*, v. 33, Sept. 1960, p. 753-759.

13185 Separation of Boron Isotopes. IV. The Methyl Sulfide-BF_3 System. Exchange of boron between BF_3 (gas) and the dimethyl sulfide-BF_3 complex (liq.) from −20 to +26 C. ***A. A. Palko and J. S. Drury.*** *Journal of Chemical Physics*, v. 33, Sept. 1960, p. 779-781.

13186 Activator Center in Magnesium Fluorogermanate Phosphors. Emission and absorption spectra and the temperature dependence of various parameters were evaluated. ***C. Kemeny and C. H. Haake.*** *Journal of Chemical Physics*, v. 33, Sept. 1960, p. 783-789.

13187 Solvent Extraction of Heptavalent Technetium. Measures extraction of heptavalent technetium initially contained in aqueous acid, neutral salt and in alkaline solutions, by a wide variety of immiscible organic liquids including alcohols, ketones, ethers, nitro-compounds, nitriles, amines, hydrocarbons, chloro-hydrocarbons and organo-phosphorus and organo-nitrogen compounds dissolved in nonpolar liquids. ***G. E. Boyd and Q. V. Larson.*** *Journal of Physical Chemistry*, v. 64, Aug. 1960, p. 988-996.

13188 The Reactions of Water Vapor With Beryllia and Beryllia-Alumina Compounds. Reactions studied in the range 1300-1575° using a transpiration technique. ***William A. Young.*** *Journal of Physical Chemistry*, v. 64, Aug. 1960, p. 1003-1006.

13189 The Thermodynamics of Bismuth-Lead Alloys. Determination of heats of formation and heat contents of solid lead-bismuth alloys. These data were correlated with previously known data in the liquid state and the phase diagram to give a complete self-consistent set of thermodynamic data for the system. ***Prodyot Roy, Raymond L. Orr, and Ralph Hultgren.*** *Journal of Physical Chemistry*, v. 64, Aug. 1960, p. 1034-1037.

13190* Kinetics of Oxidation of Ferrous Oxide Hydrate Suspensions in Solid Iron(II) Sulfate Solutions. In the oxidation of a mixture of precipitates and dissolved compounds of divalent $Fe(OH)_2 + FeSO_4$, only $Fe(OH)_2$ is oxidized in a few minutes and practically entirely. The oxidation of the dissolved salt is very slow. The oxidation of the suspensions by O is a microheterogeneous process. The speed of oxidation of $Fe(OH)_2$ suspensions containing dissolved salt in excess in solution is different from that of suspensions with excess alkali. (*In Russian.*) Kinetika okisleniia kislorodom suspenzii gidrata zakisi zheleza v vodnykh rastvorakh sul'fata zheleza(II). ***B. Matseevskii and L. Lepin'.*** *Latvijas PSR Zinātnu Akademijas Vestis*, 1960, no. 6, p. 85-88.

13191* Modification of the Catalytic Activity and Electric Conductivity of the MgO-Cr_2O_3 Mixed Oxide During the Spinel Formation. The catalytic and electric properties of this mixed oxide were investigated as functions of the sintering temperature. The decomposition of formic acid was selected as a model reaction. The mixed oxides exhibited a high activity during the spinel formation. The change in the electric conductivity revealed that the elevated catalytic activity is connected with the higher defect electrons of the transition state. (*In Hungarian.*) A krómoxid alapú keverékoxidok katalitikus és elektromos tulajdonságainak vizsgálata a spinell képzódése alatt. ***Zoltán Szabó and Frigyes Solymosi.*** *Magyar Kémiai Folyóirat*, v. 66, no. 7, July 1960, p. 275-278.

13192* Solvent Effects in the Proton Resonance Spectra of Dimethyl-Formamide and Dimethyl-Acetamide. Changes in the nuclear magnetic resonance spectra of dimethyl-formamide and dimethyl-acetamide were studied in various solvents over a range of concentrations. It is shown that addition of aromatic solvents causes the relative chemical shifts of the two methyl resonances to change sign. ***J. V. Hatton and R. E. Richards.*** *Molecular Physics*, v. 3, no. 3, May 1960, p. 253-263.

13193 Physical Chemistry of Surfaces. Capillarity; nature and thermodynamics of liquid-gas interfaces; surface films on liquid substrates; electrical aspects of surface chemistry; surfaces of solids; long-range forces; friction and lubrication; wetting, flotation, and detergency; emulsions and foams; surface areas of solids and an introduction to adsorption; adsorption of gases and vapors on solids; the surface area of solids; chemisorption and catalysis; adsorption from solution. ***Arthur W. Adamson.*** 629 pp. 1960. Interscience Publishers, New York. (QD506 Ad13p)

13194 Quantum Chemistry—Methods and Applications. Empirical, nonempirical, and semiempirical methods. ***R. Daudel, R. Lefebvre, and C. Moser.*** 572 pp. 1959. Interscience Publishers, New York. (QD471 D26q)

13195* Cobalt and Nickel Extraction From Zinc Containing Solutions. Examines extraction of Ni and Co complexes with α-nitroso-β-naphthol from very diluted aqueous solutions, using organic solvents and particularly amyl acetate and methyl-isobutylketone. It is possible to obtain a good extraction of Co at low *pH*, about 3, and of Ni at *pH* near neutrality, about 6. The good extraction can be repeated many times renewing only the aqueous phase and thus obtaining remarkable metal enrichments in the organic phase. (*In Italian.*) Estrazione con solventi di cobalto e nichel da soluzioni molto diluite contenenti zinco. ***Rolando Rigamonti and Maria Teresa Cereti Mazza.*** *Ricerca Scientifica*, v. 30, June 1960, p. 855-862.

13196 The Thermostability of Thorium Tetraiodide. Thermodynamic stability determined by measuring the equilibrium partial pressure of TiI_4 for the TiO_2-ThI_4 system over the temperature range of 637 to 745 K and the sublimation pressure of TiI_4 over the temperature range of 365 to 413 K by the Knudsen method. ***A. L. Landis and A. J. Darnell.*** *U. S. Atomic Energy Commission, NAA-SR-5394*, July 30, 1960, 13 pp. (UF767 Un3.1na Contin.)

13197* Investigations of Humic Acids in Ion Exchanger Installations. In low basic anion exchangers, loss of capacity due to absorption of humic acid can occur. Measurements in order to determine the absorption and desorption of humic acid

were taken by means of usual anion exchangers. An analytic method to distinguish between the anion exchangers of damaging humic acid and of less aggressive humic acid was proposed. (*In German.*) Untersuchungen über Huminsäuren in Ionenaustauscher-Anlagen. ***H. Kurapkat.*** *Vereinigung der Grosskesselbesitzer, Mitteilungen,* no. 67, Aug. 1960, p. 242-247.

13198* The Temperature and Counter-Ion Dependency of Cation Exchange Equilibria. Ion exchange equilibria were determined for four systems involving the nitrate and chloride salts of Ca, Mg, and Cu at temperatures of 0, 25, 54.3, 75, and 98.5 C in solutions of 0.1 ionic strength. Evidence of $CuCl^+$ formation is noted and the stability of this complex appears to be greater at higher temperatures. These system also indicate anomalous behavior in the activity coefficients of calcium nitrate and calcium chloride at temperatures of 50-75 C. Values of ΔF°, ΔH°, and ΔS° are calculated for the exchange systems. ***O. D. Bonner, G. Dickel, and H. Brümmer.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 25, nos. 1-2, July 1960, p. 81-89.

13199* Velocity of Reaction of Titanium Tetrachloride With Magnesium. The character of the reaction of $TiCl_4$ with Mg is determined by the concentration of the titanium tetrachloride. When the concentration is above $1.7 \cdot 10^2$ mol/1, its role in the gas phase on the surface of the melt is small and the speed of the process does not depend on the concentration. When this decreases, the reaction process increases in the gas phase and the velocity is governed by a reaction equation of the second order. (*In Russian.*) Skorost' vzaimodeĭstviia chetyrekhkhloristogo titana s magniem. ***R. A. Sandler.*** *Zhurnal Prikladnoĭ Khimii,* v. 33, no. 7, July 1960, p. 1465-1470.

13200* Investigation of the Thermodynamic Properties of Metallic Liquid Solutions in the Potassium-Mercury System. By measuring the electromotive force of concentration chains of K/glass/K-Hg, the partial and integral thermodynamic characteristics of the K-Hg system in the interval of temperatures from 250 to 350 C and of compositions of $N_K = 0.04992 - 0.898$ were calculated. High positive-negative divergences of the K activity and high negative divergences of the Hg activity were found. (*In Russian.*) Issledovanie termodinamicheskikh svoistv zhidkikh metallicheskikh rastvorov v sisteme kaliĭ-rtut'. ***M. F. Lantratov and E. V. Tsarenko.*** *Zhurnal Prikladnoĭ Khimii,* v. 33, no. 7, July 1960, p. 1539-1546.

COATINGS

13201 Evaluating Fine Magnet-Wire for High-Temperature Service. Realistic prediction of insulation behavior. ***H. R. Broadley and R. S. Norman.*** *Aircraft and Missiles,* v. 3, Oct. 1960, p. 40-41.

13202* New Improved Hot-Applied Tape Coating Designed for Single Thickness Application. Coating is a coal tar product. ***Dean Hale, editor.*** *American Gas Journal,* v. 187, Aug. 1960, p. 18-19.

13203* Printing on Polyethylene. Presents some simple field test methods, and closes with a glossary of terms employed. *American Pressman,* v. 70, no. 8, Aug. 1960, p. 6 + 5 pages.

13204* Coating Performance in a Marine Environment Evaluated by Statistical Methods. Painted steel drums were tested and a comparison made of four paints in two colors, on four different steel pretreatments. Film thickness is most important. ***Frank E. Cook and Arthur S. Marthens.*** *Corrosion,* v. 16, Aug. 1960, p. 117-120.

13205 Staff-Industry Collaborative Report. Tall Oil. With rosin demand pulling ahead of production capacity, tall-oil fractionators strive to meet market needs. ***Louis A. Agnello and Ellis O. Barnes.*** *Industrial and Engineering Chemistry,* v. 52, Sept. 1960, p. 726-732.

13206* Track-Resistant Coatings. *J. Chottiner and B. V. McBride.* *Insulation,* v. 6, Oct. 1960, p. 20-27.

13207 Selecting Conversion Coatings for Metal Surfaces. I. Processes. *Lester F. Spencer.* *Machine Design,* v. 32, Sept. 15, 1960, p. 154-160.

13208 Selecting Conversion Coatings for Metal Surfaces. II. Design Considerations. Evaluates the converison processes and presents details of these important design factors. ***Lester F. Spencer.*** *Machine Design,* v. 32, Sept. 29, 1960, p. 123-127.

13209 Moisture Control With Corrugated. Using wax-impregnated board to keep dampness both in and out isolates sensitive leaves and buds of hydrangea plants from root-earth moisture, cuts losses, saves time and money. *Modern Packaging,* v. 34, no. 2, Oct. 1960, p. 102-103.

13210* Reactions of Unsaturated Fatty Alcohols. XII. Polymers From Polyunsaturated Fatty Vinyl Ethers and Certain Cross-Linking Monomers. Reports the preparation and film properties of copolymers and terpolymers of unsaturated fatty vinyl ethers and allyl vinyl ether, 2-vinyloxyethyl methacrylate, and 1,2-divinyloxyethane. When properly formulated these films showed excellent adhesion, flexibility, and acid and alkali resistance, but were somewhat lacking in hardness. ***L. E. Gast, R. J. Stenberg, Wilma J. Schneider, H. M. Teeter, H. O. Schoen, B. G. Brand, and E. R. Mueller.*** *Official Digest,* v. 32, pt. 1, Aug. 1960, p. 1091-1101.

13211* Comprehensive Index of Methods of Test for Paints and Paint Materials. *Official Digest,* v. 32, pt. 2, Aug. 1960, p. 1-64.

13212* Symposium on Late Developments in Solvents for Coatings. Includes variations in solvent properties of isomeric hydrocarbons; the calculation of the evaporation rate of hydrocarbon solvents from ASTM distillation data; new developments in nitroparaffin solvents; the versatile glycol ethers in new and old film-forming compositions; and new techniques for measurement of solvent retention in furniture lacquer. *Official Digest,* v. 32, Sept. 1960, p. 1119-1230.

13213* Organic Titanium Compounds. Use in heat resistant paints, as adhesion promoters and dispersing aids. ***J. Taylor.*** *Oil & Colour Chemists' Association, Journal,* v. 43, Aug. 1960, p. 555-564.

13214* Recent Advances in the Chemistry and Technology of Fatty Acid Condensation Products. An investigation of the technique of varnish manufacture with especial reference to compatibility with hard resins, the effects of cooking and cold blending, and the film properties of the resulting varnishes. ***M. R. Mills and W. T. C. Hammond.*** *Oil & Colour Chemists' Association, Journal,* v. 43, Aug. 1960, p. 565-575.

13215* Wetting, Film Formation and Other Problems in Water-Based Industrial Stoving Paints. A review of the problems involved. ***E. S. J. Fry and E. B. Bunker.*** *Oil & Colour Chemists' Association, Journal,* v. 43, Sept. 1960, p. 640-652.

13216* The Moisture-Resistance of Cold-Cured Epoxide Resins Paints. II. The Influence of Solvent. *D. M. James.* *Oil & Colour Chemists' Association,* v. 43, Sept. 1960, p. 653-673.

13217* Review of Additives. Additives for paint viscosity and drying; curing agents for epoxies; aids for pigment suspension, dispersion, and antifloating; filming, freeze-thaw, and thickening agents; wetting and emulsifying agents; antifoamers; and fungicides. ***Charles A. Burger, et al.*** *Paint Industry Magazine,* v. 75, Sept. 1960, p. 9 + 14 pages.

13218 Oxidised Rubber Paints Resist Corrosion. Two grades are described. Coatings withstand high temperatures—up to dull red heat if pigmented with Al. ***C. Speight.*** *Paint Manufacture,* v. 30, Sept. 1960, p. 323 + 1 page.

13219 Some Aspects of Simultaneous Resin/Glass Fibre Spray Deposition. *W. Flavell.* *Plastics (London),* v. 25, Sept. 1960, p. 372.

13220* Coatings for Molded Rubber Products. Advances in polymer and coating technology provide for improved performance. ***R. L. Hawkins, Jr.*** *Rubber World,* v. 142, no. 6, Sept. 1960, p. 78-80.

13221 4 Different Ways of Coating Steel With Plastics. The Marvibond process; Whirlclad fusion bond coatings; the Kaybar process; the U. S. Steel process. *SAE Journal,* v. 68, Sept. 1960, p. 30-33.

13222 Waxing Enhances Floors. ***Walter J. Hackett and Cyril S. Kimball.*** *Soap and Chemical Specialties*, v. 36, Aug. 1960, p. 77-79.

13223* Determination of the Adherence of Enamel to Its Metallic Ground Layer. In order to obtain satisfactory quantitative adherence values in plating processes, the coating layer must be separated vertically to the basic layer. The specific separating force necessary to do this must be taken as measure for the adherence of the coating layer to the basic layer. Cites an example. (*In German.*) Zur Ermittlung des Haftvermögens von Email auf seiner metallischen Grundschicht. ***Ernst A. Franke.*** *Sprechsaal*, v. 93, no. 15, Aug. 5, 1960, p. 407-410.

See also: **13025** (viscosity of liquid mixtures); **13564** (protective coatings for Cb); **13904** (polythenes in coatings); **13921** (styrenated epoxide resins).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

13224* Multiprogram Scheduling. III.-IV. Scheduling Algorithm and External Constraints. ***E. F. Codd.*** *ACM Communications*, v. 3, July 1960, p. 413-418.

13225 Advances in Computers. Discusses general-purpose programming for business applications, numerical weather prediction, the present status of automatic translation of languages, programming computers to play games, machine recognition of spoken words, and binary arithmetic. ***Franz L. Alt, editor.*** v. I. 316 pp. 1960. Academic Press, New York. (QA76 Ad95 Vis.)

13226 Control Systems Engineering. Discusses analysis of complex systems, models, ordinary differential equations, mathematics for linear systems, introductory feedback theory, matrix methods, numerical analysis, analogue-computation techniques, linear integral equations, basic statistical theory, engineering applications of statistical theory, optimization of linear systems, systems analyses in phase space, describing functions, techniques of time-domain synthesis for control systems, analysis of sampled data systems, and elements of game theory. ***William W. Seifert and Carl W. Steeg, Jr., editors.*** 964 pp. 1960. McGraw-Hill Book Co., New York. (TJ213 Se42c)

13227* The Unit Record—Core of Data Processing. Balance in data processing as one manufacturer sees it. ***McLain B. Smith.*** *Data Processing*, v. 2, Aug. 1960, p. 33-35.

13228 Electronic Business Machines. Discusses programming for business purposes, business management and electronic data processing, computer equipment and applications. ***J. H. Leveson, editor.*** 272 pp. 1960. Philosophical Library Inc., New York. (HF5548 L57.7e)

13229* An Improved Film Cryotron and Its Application to Digital Computers. Has a time constant of less than one μsec and is approximately 100 times faster than the original crossed film cryotron. The dc dissipation is less than five μw and the active area of each element is approximately 5×10^{-4} cm^2. Describes a cryotron storage circuit and a shift register based upon a principle unique to superconductors. The shift register shown is deposited in an area corresponding to 18,000 active elements per square foot. ***V. L. Newhouse, J. W. Bremer, and H. H. Edwards.*** *I.R.E. Proceedings*, v. 48, Aug. 1960, p. 1395-1404.

13230* On the Resolving Time and Flipping Time of Magnetoresistive Flip-Flops. The flipping time of the "bridge" magnetoresistive flip-flop is calculated as a function of the energy supplied by the incoming pulse. The calculation is made by the numerical solution of the nonlinear differential equation involved. Results show that for input pulses of conceivable amplitudes the linear time constant is a good measure of the flipping time. ***A. Aharoni and E. H. Frei.*** *I.R.E. Proceedings*, v. 48, Aug. 1960, p. 1436-1448.

13231 On the Statistical Theory of Optimum Demodulation. Considers the multidimensional demodulation problem from the point of view of statistical estimation theory and derives *a posteriori* most probable signal estimates. Treats correlated signals and noises. This formulation yields a set of two matrix integral equations which must be solved for the optimum estimates. ***J. B. Thomas and E. Wong.*** *IRE Transactions on Information Theory*, v. IT-6, no. 4, Sept. 1960, p. 420-425. (TK1 In6.6it Vis.)

13232 On the Mean-Square Noise Power of an Optimum Continuous Filter for Correlated Noise. Noise processes are considered: where the noise is exponentially correlated, and in the white noise case. Gives the solution for a desired output which is an arbitrary fixed linear operation on the input polynomial. Presents tables and graphs of the mean-square error for the derivative and prediction operator for the 0th, 1st, and 2nd derivatives. ***Marvin Blum.*** *IRE Transactions on Information Theory*, v. IT-6, no. 4, Sept. 1960, p. 426-434. (TK1 In6.6it Vis.)

13233 Some Quantum Effects in Information Channels. The "photon channel" model leads to more realistic conclusions regarding information transmission. Obtained are: the maximum entropy for a narrow-band source under an average power limitation; frequency distribution (Bose-Einstein) for a wide-band power-limited source; transmission rate through a Poisson channel with additive Poisson noise. ***T. E. Stern.*** *IRE Transactions on Information Theory*, v. IT-6, no. 4, Sept. 1960, p. 435-440. (TK1 In6.6it Vis.)

13234 Improved Techniques in Diagnostic Programming. Describes a group of maintenance routine programs and equipment features used in a digital data processing system to insure against unwarranted down time. Different types of transistor failures are discussed. An explanation is given of a marginal check system used in the MOBIDIC computer and the operation of built-in alarm indicators is described. Determination and localization of computer malfunctions is explained. ***Joel J. Cohen and Lewis A. Whitaker.*** *Sylvania Technologist*, v. 13, no. 3, July 1960, p. 90-96.

13235 Analytical Development and Implementation of an Optimum Error-Correcting Code. The theory relating to the construction of group error-correcting codes is outlined and used to construct a (15,5)-triple-error-correcting code. It is shown that all (15,5)-triple-error-correcting codes have the same weight structure and all are optimum. Because of the ease of implementation of maximum-length binary shift register sequences, the (15,5)-code is then implemented using "*m*-sequences." The theory of *m*-sequences is also discussed. ***Raymond G. Fryer.*** *Sylvania Technologist*, v. 13, no. 3, July 1960, p. 101-110.

13236 What Is Cybernetics? Discusses automatic control, code systems, measures of information and parallels between artificial mechanisms and living organisms. ***G. T. Guilbaud.*** 126 pp. 1959. Williams Heinemann Ltd, London. (Q315 G94ctr)

ELECTRICAL ENGINEERING

13237* A Review of Panel-Type Display Devices. Lists among the evacuated types, the thin cathode ray tubes and the image intensifier. The solid-type displays employ the electroluminescent panel in conjunction with an *xy* matrix of electrodes. Includes descriptions of proposed gaseous displays as well as of liquid and mechanical displays. Also includes a brief discussion of switching circuits. Lists actual as well as possible applications of these devices. ***Jess J. Josephs.*** *I.R.E. Proceedings*, v. 48, Aug. 1960, p. 1380-1395.

13238* Transient Voltage and Current of Zero Sequence for One Line to Ground Fault in Cable Systems. Primarily concerned with the transient current and voltage of zero sequence for one line to ground fault; shows theoretical considerations and results of the miniature system study made by the use of an electronic differential analyzer. ***Jun-ichi Baba, Hideo Morimoto and Toshihiro Shibataki.*** *Mitsubishi Denki Laboratory Reports*, v. 1, no. 2, Apr. 1960, p. 1-14.

13239* A Contribution to the Study of the Problem of "Jumps" in Electric Circuits. A method was developed in order to determine the moments when "jumps" appear in currents and voltages in nonlinear two-terminal or three-terminal networks. In order to solve the problem, full differential equations of the network studied are not necessary, but only a few of its parameters. Gives some examples for networks applicable in radio engineering installations. (*In Russian.*) K voprosu o "skachkakh" v elektricheskikh tsepiakh. ***S. A. Drobov.*** *Radiotekhnika*, v. 15, no. 7, July 1960, p. 29-36.

13240 Thermoelectricity. Discusses fundamental concepts in thermoelectricity, basic parameters in thermoelectricity, chemical and physical properties of materials at high temperatures, measurement of material properties. ***Paul H. Egli, editor.*** 407 pp. 1960. John Wiley & Sons, New York. (QC621 Eg57t)

13241 Measurement of Thermoelectric Properties by Using Peltier Heat. Proceedings of the Conference on Thermoelectricity sponsored by the Naval Research Laboratory, Sept. 1958. Various techniques for the measurement of thermal conductivity have appeared in the literature. The most common are the comparison method and the absolute method. In both methods, it is somewhat difficult to eliminate extraneous heat transfer to the specimen, especially in the case of small specimens of low thermal conductivity. A new technique is presented which is useful for low thermal conductivity materials of small dimensions. ***T. C. Harman, J. H. Cahn, and M. J. Logan.*** Paper from "Thermoelectricity", p. 235-255, 1960. John Wiley & Sons, New York. (QC621 Eg57t)

13242* Electric Polarizability of a Short Right Circular Conducting Cylinder. A method similar to that employed by Smythe for calculating the capacitance of a freely charged short right circular conducting cylinder is used to calculate the electric polarizability tensor in the principal axis system for such a cylinder. Calculations to an accuracy of approximately five significant figures are carried out for cylinders with radius to half-length ratios of ¼, ½, 1, 2, and 4. The results are applicable to the design of artificial dielectrics. ***T. T. Taylor.*** *U. S. National Bureau of Standards, Journal of Research, Section B, Mathematics and Mathematical Physics*, v. 64B, no. 3, July-Sept. 1960, p. 135-143.

See also: **13040** (optimization in equipment design); **13494** (direct electricity generation); **13524** (measurement of wear of turbogenerator bearings).

ELECTROCHEMISTRY

13243 A Basket Cathode Electrolytic Cell for Production of Titanium Metal. By confining the electrolytic reduction of $TiCl_4$ to the interior of a porous basket-cathode the electrolyte between the anode and the cathode can be kept free of reduced chlorides of Ti eliminating undesirable reactions of reduced Ti chlorides with brickwork or O in the cell atmosphere. Semiwalls are not needed. Operating conditions are given and discussed. ***W. R. Opie and O. W. Moles.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 4, Aug. 1960, p. 646-649.

13244 Reagent for Electrolytic Etching of Chromium-Nickel Austenitic Steels. Describes a new etching reagent and the procedure for Cr-Ni steel specimens. Discusses particulars on a new electrolyte. ***Yu. B. Malevskii.*** *Henry Brutcher Translation No.* 4844, 3 pp. + 3 figures. (From *Zavodskaya Laboratoriya*, v. 24, no. 1, 1958, p. 111-112.) Henry Brutcher, Altadena, Calif.

13245* Reduction of Promethium on a Mercury Cathode. The nature of the rare earth and alkali metals, the current density, and the duration of the electrolysis have a fundamental effect on the degree of passage of Pm to the Hg cathode. During electrolysis in the presence of K ions, Pm is deposited on the cathode only in the presence of high quantities of Sa or other rare earths having a stable bivalent composition. Cerium is deposited on the cathode under the same conditions as Pm. Erbium is deposited in practical amounts. A method was developed to separate small amounts of Sa from the radioactive elements of the Ce group. (*In Russian.*) Vosstanovlenie prometiia na rtutnom katode. ***A. K. Lavrukhina, G. M. Kolesov, and Tan Siao-en.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 15 pp. (QC770 C76pr)

13246 Investigation of the Electrochemical Characteristics or Organic Compounds. V. Heterocyclic Nitro Compounds. A study of the electrochemical characteristics of nitropyridine and other heterocyclic nitro compounds shows that the cathode potential of these compounds during current flow is dependent on the aromaticity of the compound, as well as the type and position of substituent groups on the aromatic ring. ***R. Glicksman and C. K. Morehouse.*** *Electrochemical Society, Journal*, v. 107, Sept. 1960, p. 717-722.

13247 Bridged Complexes and the Deposition of Tin-Nickel Alloys. The method of continuous variations was used to determine the nature of the complex in solutions containing Sn(II), Ni(II), and fluoride ions. Complexes may contain one or more fluoride bridges. There is no indication of complex formation in the absence of fluoride. ***Robert L. Rau and John C. Bailar, Jr.*** *Electrochemical Society, Journal*, v. 107, Sept. 1960, p. 745-748.

13248* Internal Surface Plating of a Large Stainless Steel Vessel. The vessel itself was used as a bath and filled almost half full with plating solution. Describes the plating procedure. ***N. Rain and S. A. Self.*** *Electroplating and Metal Finishing*, v. 13, Aug. 1960, p. 283-284.

13249* Electro-Polishing Stainless Steel. Surface layer approximately 0.001 in. in depth is removed, thereby leveling surface imperfections; especially suitable for complex articles or assemblies. *Machinery (London)*, v. 97, Aug. 10, 1960, p. 349-350.

13250 Design Hints on . . . Electroforming. Recommendations on when to use electroforming, types of mandrels, examples of good and bad practices, deposit rates, and distribution curves for angles and holes. ***Bruce Chandler Jones.*** *Product Engineering* (Design Digest Issue), v. 31, no. 38, Mid-Sept. 1960, p. 174-177.

13251* Electric Conductivity and Viscosity of the Solvent. The Potassium-Chloride-Water-Ethylene Glycol System at 25° C. The test results, analyzed in the light of the Fuoss-Onsager theory, have permitted the computation of the coefficients of the equation of conductivity, whose validity presents deviations of 0.01%. The relating coefficients, S/Λ_0, E/Λ_0, J/Λ_0, which theoretically result being independent of the viscosity of the medium, have been compared to those of the system potassium chloride-water-glycerol previously determined. The maximum deviation is of the order of 10% correspondingly to viscosity variations of 100 times. (*In Italian.*) Conducibilità elettrica e viscosità del solvente. Sistema cloruro di potassio-acqua-glicol etilenico a 25° C. ***Flippo Accascina and Sergio Petrucci.*** *Ricerca Scientifica*, v. 30, June 1960, p. 808-815.

ELECTRONICS

13252* The New Theory of the Transistor in Saturated Operation. Problems Concerning Switching. A two dimensional model of a transistor is employed: one part, consisting of the center of the transistor, behaves as an ideal transistor without base current; the other part forms the edges of the transistor and supplies the base current. Static and other operations are studied. (*In French.*) Nouvelle théorie du transistor en régime saturé. Problémes de commutation. ***M. Carbonel.*** *Annales de Radioélectricité*, v. 15, no. 59, Jan. 1960, p. 78-89.

13253* Theory of Parametric Amplification Using Diodes. Explains parametric amplification equation and examines some of its general properties. Gives as special cases the conventional types of "up Converter" and "down Converter" parametric amplifiers, and also negative resistance amplifiers whether or not of degenerate type. (*In French.*) Theorie de l'amplification paramétrique a diode. ***F. Dachert.*** *Annales de Radioélectricité*, v. 15, no. 60, Apr. 1960, p. 109-119.

13254 The Dynamic Behavior of Thermoelectric Devices. Investigates small-signal dynamic behavior of thermoelectric devices; heat-pump analysis. ***Paul E. Gray.*** 136 pp. 1960. John Wiley & Sons, New York. (TK2950 G79d)

13255* Progress and Problems in World Communication. Discusses problems related to world-wide communication, including the length factor, transmission delay, distortion, noise, switching, and signaling. ***E. I. Green.*** *Electrical Engineering,* v. 79, July 1960, p. 569-573.

13256* Wideband Video Amplifier Design Using Mesa Transistors. Design details for a 150-mc amplifier strip having an over-all gain of 50.5 db. Simple circuitry, requiring RL shunt feedback for each stage, is in part due to the low collector capacitance assoicated with mesa transistors. ***William A. Rheinfelder.*** *Electronic Design,* v. 8, no. 17, Aug. 17, 1960, p. 46-49.

13257* A Display Unit for a Flight Simulator. English Electric Aviation, Ltd., uses a flight simulator to assess aircraft characteristics in the design and development stages. A visual representation of the ground is presented to the pilot on a c.r.t. in the simulator cockpit. Describes the design limitations and electronic techniques used in generating the display and a short account of the display in use. ***A. G. Barnes and W. F. Coulshed.*** *Electronic Engineering,* v. 32, July 1960, p. 402-407.

13258* A Transistor Switching Circuit for Power Regulation Applications. Describes a d.c. transistor amplifier circuit for power control applications. Positive feedback is used to make the amplifier oscillate continuously, the output stage being switched between bottomed and cut-off conditions. The input signal modulates the mark-to-space ratio and so varies the mean current fed to an inductive amplifier load. The primary application considered for the circuit is voltage control of shunt fed dynamos or alternators. ***M. J. Wright.*** *Electronic Engineering,* v. 32, Aug. 1960, p. 484-487.

13259* The Role of Space Charge Waves in Modern Microwave Devices. II. The basic principles of space charge waves are simply shown in the case of waves on a beam of infinite extent, possessing a uniform current density. It is possible to extend the analysis to the more practical case of a finite size beam in a metal drift tube. ***G. D. Sims and I. M. Stephenson.*** *Electronic Engineering,* v. 32, Aug. 1960, p. 499-503.

13260* Transistors in Audio- and Carrier-Frequency Amplifiers. Discusses practical methods of stabilizing both the bias point and the gain of a single stage, together with the gain and bandwidth achievable with the common-emitter connection. Analyzes a two-stage feedback circuit and illustrates the behavior by means of flow graphs. ***K. Lamont.*** *Electronic Technology,* v. 37, Aug. 1960, p. 292-299.

13261 How a Closed-Circuit Pay TV System Works. Describes on a functional level, program delivery transmitters, distribution equipment, coin-operated subscriber attachment and accounting machine. Discusses control logic circuit for subscriber attachment. ***Patrick R. J. Court, Carl A. S. Akrell, Abraham M. Reiter, and Glenn S. Kimball.*** *Electronics,* v. 33, no. 34, Aug. 19, 1960, p. 49-55.

13262 Combining Transistors With Tunnel Diodes. Bistable memory elements and circuits with N-type characteristics can be obtained with transistor-tunnel diode combinations. ***Carl David Todd.*** *Electronics,* v. 33, no. 34, Aug. 19, 1960, p. 59-61.

13263 Broad-Band Frequency Scanning Radar System. The system sequentially scans seven frequencies in the 6 to 50-Mc band at 60 frequencies per sec, operates on a coherent basis in providing doppler data on each frequency, has a peak power of approximately 15 Kw and sufficient sensitivity to insure that the detected noise level is set by atmospheric or cosmic noise. The system uses log-periodic antenna yielding a gain of approximately 10 db and a VSWR (voltage standing wave ratio) under 2.5:1. ***S. R. Hennies and J. V. N. Granger.*** *Electronics,* v. 33, no. 36, Sept. 2, 1960, p. 44-47.

13264* Low-Noise Parametric Amplifier. The theory of the parametric amplifier has been reformulated to permit the prediction of noise temperature and pump power in terms of the physical parameters of the nonlinear element and circuit. Results of this analysis are supported by careful experiments at S-band using a gold-bonded Ge semiconductor diode. ***R. C. Knechtli and R. D. Weglein.*** *I.R.E. Proceedings,* v. 48, July 1960, p. 1218-1226.

13265* Theory of Single-Resonance Parametric Amplifiers. A parametric amplifier that supports a resonance at the idler frequency only is capable of unlimited gain when operated either as a straight-through amplifier or as a lower-sideband upconverter. In the latter case, the idler frequency becomes the output frequency. ***Sydney T. Fisher.*** *I.R.E. Proceedings,* v. 48, July 1960, p. 1227-1232.

13266* Unidirectional Paramagnetic Amplifier Design. Describes and discusses the radio-frequency parameters and the quantum-mechanical parameters entering into the design of paramagnetic quantum-mechanical amplifiers. Physical and electrical limitations on such parameters as gain-bandwidth product, gain stability, and nonreciprocity are described analytically and with design curves. Describes and discusses two realizations of nonreciprocal amplifiers. ***M. W. P. Strandberg.*** *I.R.E. Proceedings,* v. 48, July 1960, p. 1307-1320.

13267* Gallium Arsenide Tunnel Diodes. Describes devices which were fabricated consistently with peak to valley current ratios $>15:1$, with voltage swings in the range from 0.9 to 1.2, and with current densities from 2000 amp/cm^2 to over 10,000 amp/cm^2 (and with correspondingly low capacitances, e.g., capacitances as low as 0.2 $\mu\mu$f/ma and g/C figures of merit as high as 5×10^{10} sec^{-1}. ***N. Holonyak, Jr. and I. A. Lesk.*** *I.R.E. Proceedings,* v. 48, Aug. 1960, p. 1405-1409.

13268* The Reflected-Beam Kinescope. Retains the conventional gun and external deflection components and is axially symmetric. Although the effective deflection angle is nearly 180°, the deflection power required is equivalent to that used in conventional 90° kinescopes. The electron beam scans through an apertured phosphor screen and is reflected back to the screen by the faceplate. The screen attenuates the beam by a factor of 4, except in the case of a radial scan where a cutout in the center of the screen may be made to permit free passage of the beam. ***H. B. Law and E. G. Ramberg.*** *I.R.E. Proceedings,* v. 48, Aug. 1960, p. 1409-1417.

13269* Shot Noise in Tunnel Diode Amplifiers. It is found that the noise figure has a broad minimum centered about a point slightly higher in bias than the bias value for maximum negative conductance. ***J. J. Tiemann.*** *I.R.E. Proceedings,* v. 48, Aug. 1960, p. 1418-1423.

13270* A Parametric Device as a Nonreciprocal Element. Proposes a parametric device which is equivalent to a passive nonreciprocal phase shifter. A first-order analysis is made assuming the series resistance effect in the variable capacitance diode to be negligible and a dispersion theory for matching and bandwidth of the nonreciprocal element is developed. Exhibits the nonreciprocal phase behavior of the device experimentally over a narrow frequency band. ***A. K. Kamal.*** *I.R.E. Proceedings,* v. 48, Aug. 1960, p. 1424-1430.

13271* The Compatibility Problem in Single-Sideband Transmission. Shows that absolute compatibility with standard AM receivers employing a linear envelope detector cannot possibly be achieved with the spectral economy of conventional single sideband. However, if one conveys the message function in the square of the envelope rather than in the envelope itself, a phase function can be found for which the hybrid wave occupies a spectral width equal to that of a conventional single-sideband (SSB) system. Distortionless detection is achieved with a square-law envelope detector. ***K. H. Powers.*** *I.R.E. Proceedings,* v. 48, Aug. 1960, p. 1431-1435.

13272* Noise in Oscillators. During the initiation of oscillation, noise constitutes the starting voltage and therefore affects the time required for the wave to reach some pre-established amplitude. The resulting jitter in the starting time of pulsed oscillators is objectionable because it degrades the signal-to-noise ratio in systems employing super-regenerative receivers or pulse-time modulation. The time and spectral distributions of noise effects in typical oscillators are derived and discussed. ***W. A. Edson.*** *I.R.E. Proceedings,* v. 48, Aug. 1960, p. 1454-1466.

13273* Background Noise in Nonlinear Oscillators. Shows that the noise output from noise bands around the oscillatory frequency is composed of an additive noise of the shape of the oscillator resonant circuit and a very small FM broadening of the oscillator line. A noise generator across the oscillator terminals will produce the same amount of additive noise in the load as if the nonlinearity were absent, but the upper and lower sidebands are fully correlated, not independent as in the linear case. The noise bandwidth of the additive noise can be determined by the passive elements and the change in oscillator output power with changing load conductance at the operating load conductance. When the load conductance is adjusted for maximum oscillator output power, the noise bandwidth is the same as if the value of load conductance gave maximum power from a linear circuit. ***James A. Mullen.*** *I.R.E. Proceedings*, v. 48, Aug. 1960, p. 1467-1472.

13274* Monochromaticity and Noise in a Regenerative Electrical Oscillator. The regenerative oscillator is postulated to be equivalent to an RLC circuit in which a negative resistance—R_n, placed parallel with R, has a value which is a slowly varying function of the mean-square voltage across it. Expressions are derived for the departure from monochromaticity of the regenerative oscillator so represented, as well as for the intensity and bandwidth of the thermal noise generated in the oscillator by the resistance R. ***Marcel J. E. Golay.*** *I.R.E. Proceedings*, v. 48, Aug. 1960, p. 1473-1477.

13275 Impedance Properties of Complementary Multiterminal Planar Structures. Booker shows that Babinet's principle, properly extended to electromagnetic fields, leads to a simple relation between the impedances of two planar complementary structures. A relation, which generalizes this result, is found between the impedance matrices of two complementary n-terminal structures. This relation is applied to the particular n-terminal structures having n-fold symmetry and to those that are also self-complementary. By connecting in groups the terminals of such a structure, various impedance levels, all frequency independent and real, may be achieved. Considers structures having their terminal pairs in different locations in the plane. A self-complementary two-port structure is found to be equivalent, from the impedance point of view, to a length of lossy transmission line having a characteristic impedance of 60π ohms. ***Georges A. Deschamps.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S371-S378. (TK1 In6.6ap Vis.)

13276 The Numerical Solution of Antenna and Scattering Problems. ***George Sinclair.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S402-S405. (TK1 In6.6ap Vis.)

13277 The Finite Conical Antenna. The antenna consists of a perfectly conducting cone of finite length excited at its tip by a linear element. The radiation patterns and radiation resistance have been calculated by taking the current distribution on the linear element to be sinusoidal and approximating the current distribution on the finite cone with that of an infinite cone. Calculated and measured radiation patterns are found to be in good agreement. Discusses dependence of beamwidth, beam tilt, and side-lobe level on the antenna dimensions. ***S. Adachi, R. G. Kouyoumjian, and R. C. Van Sickle.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S406-S411. (TK1 In6.6ap Vis.)

13278 Broadband Multislot Antenna. A multislot antenna was built, of which the VSWR is smaller than two in the band of 100 to 1000 mc. The principle of this antenna is analogous to the one of pass band filters in which few modes of resonance are possible, appearing one after the other when frequency varies in the band. ***P. Marie.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl. Dec. 1959, p. S412-S413. (TK1 In6.6ap Vis.)

13279 Resonance and Supergain Effects in Small Ferromagnetically or Dielectrically Loaded Biconical Antennas. ***Charles Polk.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S414-S423. (TK1 In6.6ap Vis.)

13280 The Calculated Phase Velocity of Long End-Fire Uniform Dipole Arrays. ***F. Serracchioli and C. A. Levis.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S424-S434. (TK1 In6.6ap Vis.)

13281 Network Theory and Its Relation to the Theory of Linear Systems. ***J. Meixner.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S435-S439. (TK1 In6.6ap Vis.)

13282 Linear Arrays: Currents, Impedances, and Fields. I. Derives a new solution for the currents, which provides a good approximation for the currents in arrays of elements that may be a full wavelength long or longer, and which is expressed in terms of combinations of simple trigonometric functions. ***Ronold King.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S440-S457. (TK1 In6.6ap Vis.)

13283 A New Method of Near Field Analysis. ***R. C. Hansen and L. L. Bailin.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S458-S467. (TK1 In6.6ap Vis.)

13284 Back Scattering at High Frequencies From a Conducting Cylinder With Dielectric Sleeve. ***Ralph D. Kodis.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S468-S470. (TK1 In6.6ap Vis.)

13285 Modes in Rectangular Guides Partially Filled With Transversely Magnetized Ferrite. Summarizes the results in 15 diagrams giving the propagation constant vs the ferrite slab thickness. Concludes that: propagating modes of any order may exist; modes of zero order are not always the lowest propagating modes, in the sense that higher order modes can propagate when zero order modes are attenuated; and cases can exist when all the unattenuated propagating modes travel in the same sense. ***G. Barzilai and G. Gerosa.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, Special Suppl., Dec. 1959, p. S471-S474. (TK1 In6.6ap Vis.)

13286 Experimental Swept-Frequency Tropospheric Scatter Link. An experimental swept-frequency tropospheric scatter link, with a path length of 194 miles, was established in France between Cholet and Corbeville. The transmitter sweeps in a nearly linear manner from 3100 to 3600 mc and back to 3100 mc at about 10 cps. Preliminary data obtained from the link indicate that privileged transmission frequencies exist at all times in this band at which the transmission level is about 10 db above median. ***W. E. Landauer.*** *IRE Transactions on Antennas and Propagation*, v. AP-8, no. 4, July 1960, p. 423-428. (TK1 In6.6ap Vis.)

13287 Some General Problems of Absorption Measurements in the Cell. Describes the physical, chemical, and optical properties of various substances in the living cell, fundamental for their microspectrographic analysis. Discusses some limits of the present technique. ***B. Thorell.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 3, July 1960, p. 119-122. (TK1 In6.6m Vis.)

13288 The Application of Ultraviolet Absorbence Measurements to Problems in Cell Biology. Micro-assays of the total amount of a UV absorbing compound in a structure enable a study of the metabolism of that compound to be made in reference to the function of the structure. Both types of analysis are possible in the spectral range between 230 and 300 mμ where the absorption peaks of the biologically important nucleic acids (260 mμ) and proteins (280 and less than 250 mμ) lie. Outlines the application of the method to a study of nucleic acid metabolism in chromosomes. It was shown that nucleic acid metabolism varies from place to place along a chromosome and with time at any one place, a finding that has significance with respect to the variety of functions in heredity associated with different regions of a single chromosome. Suggests that the future use of the method will be enhanced by the development of rapid scanning techniques and of auxiliary chemical and physical methods on a micro scale. ***George T. Rudkin.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 3, July 1960, p. 122-129. (TK1 In6.6m Vis.)

13289 The Use of Television and Scanning Techniques for Ultraviolet Irradiation Studies of Living Cells. A major use of this technique is the study of ultraviolet irradiation damage in living cells. Recent advances now enable one to perform experiments designed to elucidate the relationship be-

tween total cellular damage and cellular component damage. Describes methods for the simultaneous utilization of two wavelengths of light for the illumination of different portions of a single living cell. ***P. O'B. Montgomery and L. L. Hundley.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 3, July 1960, p. 135-138. (TK1 In6.6m Vis.)

13290 Opacities in the Lens of the Eye Experimentally Induced by Exposure to Microwave Radiation. Lens opacities result from exposure of the rabbit eye to 2450-mc continuous wave radiation. Threshold for a single damaging exposure is determined by power density and duration. Opacities may also result as a cumulative effect of repeated subthreshold exposures. Intraocular temperature increases during irradiation, the extent and the rate of increase being related to power density. Inasmuch as a particular temperature critical for opacity induction cannot be identified, it is suggested that the intraocular thermal response may be coincident with, rather than the cause of, induction of opacities. Lens damage may result in irradiation at power levels not sufficient to cause discomfort to nonanesthetized animals. Pulsed radiation with high peak intensities appears to be more potent in inducing lens opacities than continuous wave radiation of equal average power. Since ocular temperature is related to average rather than to peak power, these findings further suggest the possibility of a nonthermal biological effect of microwave radiation. ***R. L. Carpenter, D. K. Biddle, and C. A. Van Ummersen.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 3, July 1960, p. 152-157. (TK1 In6.6m Vis.)

13291 Fundamental Neurological Research and Human Neurosurgery Using Intense Ultrasound. Now being used in an extensive experimental animal program involving neuroanatomical, behavioral, and physiological studies. Also used to study and modify the symptoms of various neurological disorders in humans. The signs and symptoms which have been and are under investigation in human patients at the present time include abnormal movements (tremor and nonpatterned), muscular rigidity, intractable pain (following amputations, cerebral vascular accidents, the acute phase of herpes zoster) and hypersensitivity to stimulation of the body surface. ***W. J. Fry and F. J. Fry.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 3, July 1960, p. 166-181. (TK1 In6.6m Vis.)

13292 A Blood Flowmeter for Use in Coronary Heart Disease Research. Development work towards extending the range of an electromagnetic type flowmeter. Critical system parameters in this particular application were found to be the input impedance level and coupling methods of the preamplifier, phase accuracy of the timing voltages, and common-mode rejection of the carrier amplifier. Significant but relatively less important factors are the coil-drive method, the waveshape of the coil-drive current, and the noise level of the gating system. ***Francis A. Giori.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 3, July 1960, p. 211-216. (TK1 In6.6m Vis.)

13293* Input and Passage Conductivity of a Transistor in Unsteady Conditions. Theoretical expressions for the transient and phase frequency characteristics of the total admittance of the input circuit and of the total forward transfer admittance of the common base-connected transistor with output short-circuited are derived. Several particular cases are examined. Shows that the transistor input reactance is determined by the ratio of spreading base resistance to the differential emitter resistance. (*In Russian.*) Vkhodnaia i prokhodnaia provodimosti tranzistora v nestatsionarnom rezhime. ***E. I. Adirovich.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 3, no. 7, July 1960, p. 28-36.

13294* On the Distortion of the Modulation of High-Power Radio Waves Propagated Through the Ionosphere. I. Experimental Study. Describes a method of experimental investigation of nonlinear distortions of the modulation of radio waves on their propagation through the ionosphere. Describes apparatus for the measurement and cites preliminary investigation results. (*In Russian.*) Ob iskazhenii moduliatsii moshchnykh radiovoln pri ikh rasprostranenii v ionosfere (eksperimental'noe issledovanie). I. ***I. M. Vilenskiĭ, V. P. Chernyshov, and D. I. Sheinman.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Radiofizika*, v. 3, no. 3, 1960, p. 367-374.

13295* Some Results of the Measurement of the Absorption of Radio Waves in the Ionosphere. Discusses the results of measurement of the absorption of radio waves in the ionosphere on frequencies of 2.2 and 3.0 megacycles, carried out from June 1958 to June 1959. Describes method of measurement and the used apparatus. Cites and compares the median values at midday of absorption, of the minimum frequency of reflection, and of the critical frequency of the *E*-layer. (*In Russian.*) Nekotorye rezul'taty izmereniia pogloshcheniia radiovoln v ionosfere. ***A. M. Svechnikov, Iu. K. Chasovitin, and N. A. Kochenova.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Radiofizika*, v. 3, no. 3, 1960, p. 375-383.

13296* Technics of Nanosecond Impulses. (Review). Reviews the modern state of technics of generation, amplification, transmittance and observation of nanosecond impulses. (*In Russian.*) Tekhnika nanosekundnykh impul'sov. (Obzor). ***G. V. Glebovich and L. A. Morugin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Radiotekhnika*, 1960, no. 2, Mar.-Apr., p. 137-152.

13297* Low Frequency Parameters of the Amplified Spacistor-Triode. Examines the relations between low-frequency parameters of a three-electrode spacistor. Discusses the dependence of the transconductance S and of the amplification factor of the voltage μ on the regime of operation of the spacistor and on its geometry. (*In Russian.*) Nizkochastotnye parametry usilitel'nogo speĭsistora-trioda. ***A. L. Zakharov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Radiotekhnika*, 1960, no. 2, Mar.-Apr., p. 233-246.

13298* The Control of the Frequency of the Quartz Self-Excited Oscillator. The obtained correlations for the characteristic of the control, of the temperature and condition coefficients of the frequency can be used on analysis of different schemes of controllable and uncontrollable quartz-excited oscillators. (*In Russian.*) Upravlenie chastotoĭ kvartsevogo avtogeneratora. ***E. G. Servinskiĭ.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Radiotekhnika*, 1960, no. 2, Mar.-Apr., p. 254-260.

13299* Statistical Analysis of Fading of a Single Down-Coming Wave. Shows that the amplitude distribtuion is Rayleigh only in the case of rapid fading, whereas for slow and quasi-periodic fading it is found to represent what can be termed as an *M*-type. For a Rayleigh amplitude distribution this time analysis gives rise to a Type-VII distribution of Pearson as originally pointed out by Mitra (1949b), while in the case of *M*-type amplitude distribution it becomes Gaussian. ***P. Dasgupta and K. K. Vij.*** *Journal of Atmospheric and Terrestrial Physics*, v. 18, no. 4, Aug. 1960, p. 265-275 + 2 plates.

13300* Changes in the Fading Speed of Low-Frequency Radio Waves. Fading speed changes with frequency as a result of the change of wavelength and also because of the change in height of reflection. It is thus not expected to find a linear relationship between fading speed and frequency over a range of frequencies. ***W. A. Cilliers.*** *Journal of Atmospheric and Terrestrial Physics*, v. 18, no. 4, Aug. 1960, p. 339-341.

13301* Effects of Transfer Circuits on the Ground Field of a Radiowave. Studies the possibility to reduce by approximation the problem of the disturbance of the primary field of a transfer conceived as a thin rectilinear conductor parallel to the ground surface, to the investigation of the wave process in a certain two-wire circuit. Obtains simple asymptotic formulas for the evaluation of the basic effects. (*In Russian.*) Vliianie liniĭ peredach na nazemnoe pole radiovolny. ***V. N. Krasil'nikov.*** *Radiotekhnika*, v. 15, no. 7, July 1960, p. 3-9.

13302* The New Theory of a Self-Contained Four-Pole and Application to an Amplifier With Distributed Amplification. New parameters, called characteristic voltages and currents, are introduced about an independent quadripole. A theory of cascade connection of matched autonomous four-poles with a symmetrical body is developed and formulas are given for the calculation of the voltages and currents at the ends of the circuits, irrespective of the load. Formulas are obtained for the coefficient of amplification of the amplifier with calculation of mismatching for the two ends of the grid and anode circuits. (*In Russian.*) Novaia teoriia avtonomnogo chetyrëkhpoliusnika i eë primenenie k usiliteliu s raspredelënnym usileniem. ***E. V. Zeliakh.*** *Radiotekhnika*, v. 15, no. 8, Aug. 1960, p. 13-24.

13303* Improving the Frequency-Phase Characteristics of Selective Amplifiers With Feedbacks in Case of High Detunings. In selective amplifiers with a frequency-conditioned feedback, the amplification in the case of considerable separation from the quasi-resonance frequency tends towards the unit, and not towards zero, as in resonance amplifiers. This decreases the selectivity and noise-proof feature of feedback amplifiers. Suggests two methods to eliminate this residual amplification. (*In Russian.*) Uluchshenie chastotno-fazovoĭ khrakteristiki izbiratel'nykh usiliteleĭ s obratnoĭ sviaz'iu pri bol'shikh rasstroĭkakh. ***V. L. Zmudikov.*** *Radiotekhnika*, v. 15, no. 8, Aug. 1960, p. 53-56.

13304* Program Control of Amplifiers. A problem in telecommunications is the necessity to vary the action of an electronic amplifier according to a predetermined time program. Methods dealing with this problem are discussed and practical means for their realization are considered. (*In German.*) Programmsteuerung von Verstärkern. ***A. Séthy.*** *Regelungstechnik*, v. 8, no. 6, June 1960, p. 201-203.

13305 Solid State Physics in Electronics and Telecommunications. II. Magnetic and Optical Properties. Proceedings of an International Conference held in Brussels, June 2-7, 1958. Discusses masers, electroluminescence, phosphors, applications of photosensitive materials, miscellaneous problems, and radiation damage. ***M. Désirant and J. L. Michiels, editors.*** v. IV. 405 pp. 1960. Academic Press, New York. (TK7872.S4 So44)

13306 FM-CW Radar Now More Attractive to Guidance Designers. Practical design problems kept FM-CW radar from reaching its full theoretical performance potential. New designs have overcome these problems, and FM-CW now is a subject of great interest for aerospace guidance. ***G. J. Bonnelle.*** *Space/Aeronautics*, v. 34, no. 2, Aug. 1960, p. 143-148.

13307 Off-the-Shelf Telemetry Transmitter for Recon Satellites. The transmitters in RCA's Tiros I payload are a pair of off-the-shelf telemetry units. ***Bernard Kovit.*** *Space/Aeronautics*, v. 34, no. 2, Aug. 1960, p. 149-151.

13308 Statistical Theory of Signal Detection. ***Carl W. Helstrom.*** v. IX. 364 pp. 1960. Pergamon Press, New York. (TK5101 H36s)

13309 Ferroelectric Ceramics. Describes conventional procedures employed in the preparation of these materials and discusses a hot-pressing technique. Shows that materials produced by the latter method have superior electrical properties. Electrical tests are described and the procedures found to be best in polishing, etching and sample preparation for electron photomicrography are discussed. Recent advances in poling by use of pulsed fields are reported as well as the influence of additives, especially lanthanum oxide in barium-strontium titanate and lead niobate in lead zirconate-titanate. ***Alfred Kremheller and Paul W. Renaut.*** *Sylvania Technologist*, v. 13, no. 3, July 1960, p. 82-89.

13310 A Ferrous Fluoborate Iron Plating Application for Microwave Tubes. Describes an improved method for electroplating Fe on W traveling wave tube components to provide attenuation of rf energy. A ferrous fluoborate plating bath is used for this purpose; it involves problems in bath maintenance, pitting, and loss of throwing power. Discusses these problems and the corrective techniques that were developed. ***Carol Zabel and Elston Flores.*** *Sylvania Technologist*, v. 13, no. 3, July 1960, p. 97-100.

13311 Investigations of Rare-Earth Oxide Cathodes. The thermionic emission from a gadolinium oxide sample was determined to be 1.6 amp-cm^{-2} at 1400 C. The calculated emission at 1500 C is 4.4 amp-cm^{-2}. Diodes employing a mixture of gadolinium and neodymium oxides exhibited high emission values at low temperatures but tend to be unstable at temperatures above about 1300 C. This instability will be studied. ***G. B. Gaines.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TN-60-559*, Mar. 1960, 16 pp. (TK7800 Un3.12c Contin.)

13312 Investigations of Rhenium for Electron-Tube Applications. Shows that Re is relatively inert to Al_2O_3, is hardened by C, and reacts readily with boron trichloride to form brittle borides. While Re does not show unusual properties in alkaline-earth cathodes, Re matrices containing W and Mo show promise for application in pressed-dispenser-type cathodes. Increasing additions of Re to Mo and W greatly improve the hot workability, hot strength, low-temperature ductility, recrystallization characteristics, and weldability of these metals. Alloys based on Mo-28Re or W-25Re show optimum properties. ***D. J. Maykuth, et al.*** *U. S. Air Force, Cambridge Research Center, AFCRC TR-60-153*, Mar. 1960, 80 pp. + appendixes. (TK7800 Un3.12b Contin.)

13313 Investigation on Ceramic Seals for Electron Tubes. Two types of seals are needed in vacuum tubes: a ductile braze for subassembly to accommodate some mismatch of expansion coefficients, and a reactive seal with suitably low vapor pressure and temperature for making the final seal in a vacuum. These requirements are met by a copper braze to a metallized ceramic and a reactive seal of Ni-Ti eutectic for the final seal. Details for making each type of seal are discussed. ***Austin H. King.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-60-151*, Apr. 25, 1960, 25 pp. + 13 illustrations. (TK7800 Un3.12b Contin.)

13314 High Energy Storage Ceramic Capacitor. Goal of the project was to develop a high-energy storage capacitor for pulse applications, capable of withstanding electrical stresses of 500 v/mil at room temperature, and embodying a ceramic dielectric with a dielectric constant of 1500. A solid solution containing 35% $SrTiO_3$ and 65% $BaTiO_3$ was formed into ceramic disks with densities as high as 99% of the theoretical value. Contouring of the surfaces of the capacitors to prevent edge breakdown was accomplished by ultrasonic and diamond-wheel grinding. Application of electrodes by evaporation of metallic silver proved satisfactory for most of the testing. The highest measured dielectric strengths were slightly in excess of 400 v/mil for 1-inch capacitors and 200 v/mil for 5-inch disks. ***Philipp H. Klein, editor.*** *U. S. Atomic Energy Commission, NYO-9076*, Feb. 29, 1960, 78 pp. + 14 appendixes. (UF767 U3uy Contin.)

13315* Characteristics of 488 Megacycles Per Second Radio Signals Reflected From the Moon. Radio signals at 488 megacycles per second, received after reflection from the moon, were studied using a continuous wave bistatic radar system located near Ottawa, Canada. These experiments were carried out during 1957 and consisted of monitoring the signals received on two orthogonal dipoles mounted at the focus of a 28-ft parabolic tracking antenna. The total mean received signal yielded an effective radar cross section of the moon at this frequency of 0.05 of the projected area. ***B. C. Blevis and J. H. Chapman.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 64D, no. 4, July-Aug. 1960, p. 331-334.

13316* The Use of Polarization Fading of Satellite Signals to Study the Electron Content Irregularities in the Ionosphere. At frequencies as low as 20 Mc the rotation of the plane of polarization cannot be assumed to be proportional to $\int NB \cos \theta dl$ along the line of sight. The simplifying assumptions implied by this expression are avoided, and full account is taken of ionospheric refraction, using the collision-free form of the Appleton-Hartree equation. Results based on observations of 1958 Delta 2 are presented. ***C. Gordon Little and Robert S. Lawrence.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 64D, no. 4, July-Aug. 1960, p. 335-346.

13317* Daytime Attentuation Rates in the Very Low Frequency Band Using Atmospherics. Daytime attenuation characteristics were computed by comparing the amplitude spectra of atmospheric waveforms recorded at four widely separated stations. The results of these attenuation measurements are presented for the band of frequencies from 3 to 30 kc per sec and involving distances of 1,000 to 10,000 km. It was found from these data that attenuation was about seven to nine decibels per 1,000 km at 6 kc per sec and decreases to about one to three decibels per 1,000 km at frequencies greater than 10 kc per sec. ***W. L. Taylor.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 64D, no. 4, July-Aug. 1960, p. 349-355.

13318* Half-Wave Cylindrical Antenna in a Dissipative Medium: Current and Impedance. An integral equation for the distribution of current along a cylindrical antenna in a conducting dielectric is derived. Shows that the boundary conditions for an antenna in such a medium are formally the same as for an antenna in free space. The equation is solved for the current *I* and the driving-point impedance Z by means of a technique that achieves sufficiently high accuracy in the leading terms of an iteration procedure so that the higher-order terms do not need to be evaluated. ***Ronold King and Charles W. Harrison.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 4, July-Aug. 1960, p. 365-380.

13319* Some ELF Phenomena. Discusses properties of the electric and magnetic fields in natural extremely low-frequency (ELF) phenomena. The ELF fluctuations in the electric field are then treated from two aspects; these are the electromagnetic changes associated with atmospherics and the electrostatic variations in atmospheric electricity. ***E. T. Pierce.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 4, July-Aug. 1960, p. 383-386.

13320* Mode Theory and the Propagation of ELF Radio Waves. The mode theory of propagation of electromagnetic waves at extremely low frequencies (ELF) (1.0 to 3,000 cycles per sec) is discussed. Starting with the representation of the field as a sum of modes, approximate formulas are presented for the attenuation and phase constants. Certain alternate representations of the individual modes are mentioned. These are used as a basis for describing the physical behavior of the field at large distances from the source, particularly near the antipode of the source. ***James R. Wait.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 4, July-Aug. 1960, p. 387-404.

13321* Possible Application of the System Loss Concept at ELF. Describes possible application of the system loss concept at extremely low frequencies. Outlines a method for allowing for the effect of external noise levels. ***Kenneth A. Norton.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 4, July-Aug. 1960, p. 413-414.

13322* Measurements of the Spectrum of Radio Noise From 50 to 100 Cycles Per Second. Experimental spectra of radio noise in the band of about 50 to 100 cycles per sec were obtained by means of digital processing. Due to the long integration times which were used, the statistical uncertainty in the estimates of power was reduced to about 3% (0.13 decibel). It was hoped in this way to observe maximums in the spectrum due to excitation of higher resonant modes of the earth-ionosphere cavity. ***M. Balser and C. A. Wagner.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 4, July-Aug. 1960, p. 415-418.

13323* Effects of the Periodicity of Pulses in the Corona Discharge on the High Frequency Spectrum. The pulse frequency of the Trichel pulse produced in the negative corona discharge varies by a mean value according to a Gauss distribution. This produces a continuous superimposed high-frequency spectrum, with portions varying according to the operative parameters. Depending upon the frequency, the spectrum of the discharge current reflects a relationship produced for this impulse modulation. (*In German.*) Der Einfluss des Periodizität der Impulse in der Korona-Entladung auf das hochfrequente Spektrum. ***Werner Heintz.*** *Zeitschrift für Angewandte Physik,* v. 12, no. 7, July 1960, p. 320-322.

See also: **13206** (track-resistant coatings).

ENGINEERING ECONOMICS

13324* Consumers' Propensities to Hold Liquid Assets. The results suggest that the propensity to hold liquid assets is: low for consumers who can expect long-run increases in income, higher for consumers who have permanently low incomes, increases with age to a limit, and decreases as the consumer unit becomes larger. ***Harold W. Guthrie.*** *American Statistical Association, Journal,* v. 55, no. 291, Sept. 1960, p. 469-490.

13325* The Need for New Economic Unorthodoxy. Discusses the possibility that the age of affluence has resulted in an economic orthodoxy so deeply ingrained that any dissent is disrespectable. There are very few economic heresies to compete with conventional thought and give impetus to progress. ***Neil W. Chamberlain.*** *Business Horizons,* v. 3, no. 2, Summer 1960, p. 21-31.

13326* Creeping Inflation Causes and Consequences. Careful analysis of recent inflationary processes indicates that neither of the traditional theories—"cost-push" or "demand-pull"—offers a satisfactory explanation. Perhaps we should look for inflationary pressures in particular segments of the economy rather than put all the burden on over-all cost or demand factors. ***Charles L. Schultze.*** *Business Horizons,* v. 3, no. 2, Summer 1960, p. 65-77.

13327 Current Projects on the Economic and Other Impacts of Scientific Research and Development, 1959. This project was undertaken by the National Science Foundation in response to widespread demand for information on research presently being conducted in this field. Resulting from the survey is this inventory of projects in colleges and universities. The findings indicate the awareness on the part of scholars in the social sciences of the problems raised by the increasing importance of science and technology. 59 pp. 1959. National Science Foundation, Washington 25, D. C. (T176 N21.7b)

13328 Your Guide to the New Industrial Markets. Dun's review has made a special and exclusive analysis of the new U.S. Census of Manufactures. This new market guide reveals that in the entire national industrial market, $5 out of every $6 of value added by manufacture is centered in 100 top industrial areas, which account for 469 counties out of the national total of 3,072. ***Thomas Kenny.*** *Dun's Review and Modern Industry,* v. 76, no. 1, July 1960, p. 46 + 8 pages.

13329* The Ideal Site as a Point of Equilibrium. The optimum location for a factory or distribution center may be determined graphically, using a procedure based on the polygon of forces. ***Jack I. Hanania, Khalil M. Malouf, and Ivan A. Rubinsky.*** *Engineering,* v. 190, Aug. 12, 1960, p. 210-211.

13330* U. S. Maintenance Is Next Target for Foreign Competition. Within ten years, plant maintenance in free Europe will be as advanced as in the U.S., and in these plants workers are being paid at a fraction of the going U.S. rates for the same work. The author predicts a terrific competitive struggle for world markets. ***Robert B. Wilson.*** *Factory,* v. 118, Sept. 1960, p. 119-122.

13331 Growth of Commerce on the Columbia River. Pacific Northwest Al, ferroalloys, P, and many other electrometallurgical and electrochemical products owe their existence to the great quantities of very low-cost Columbia River hydroelectric power transmitted to all points of the Pacific Northwest by means of a high-capacity transmission networks. ***Ivan Bloch.*** *Financial Analysts Journal,* v. 16, no. 4, July-Aug. 1960, p. 7 + 6 pages.

13332 Are Inventories Really Too High? Since management has greatly improved its methods of controlling inventories and made them more sensitive to business conditions, there is less danger of high inventories. ***Charles A. Bliss.*** *Harvard Business Review,* v. 38, no. 5, Sept.-Oct. 1960, p. 53-60.

13333* Competition—A More Significant Factor in the Sixties. As the factors which will govern the selection of sites for future facilities are studied, the increasing importance of competition for new materials and specialized manpower should not be overlooked. The patterns of supply which existed yesterday may be distinctly different tomorrow. ***David H. Dawson.*** *Industrial Development,* v. 129, no. 9, Aug. 1960, p. 6-10.

13334* A Frontier of Growth Potential. In this annual report on progress in Canada, *Industrial Development* spotlights important economic developments of the past year and presents discussions on industrial investment opportunities there, now, and in the future. *Industrial Development,* v. 129, no. 9, Aug. 1960, p. 20 + 27 pages.

13335* How Monsanto Measures the Value of Its Marketing Activities. Method of determining how many dollars of sales are produced by each dollar of marketing cost. The meas-

ure, though crude, is a worthwhile and helpful tool. ***Edmund Greene.*** *Industrial Marketing*, v. 45, Sept. 1960, p. 39-42.

13336* How Important Has Marketing Research Become? Top management forum gives its opinions. ***John A. Carter, Thomas G. Murdough, C. W. Beck, and C. E. Smith.*** *Industrial Marketing*, v. 45, Sept. 1960, p. 164 + 2 pages.

13337* Pitfalls of New-Product Development. A company organization itself is often a drawback to the successful development of new products. ***Harold L. Garbarino.*** *Industrial Research*, v. 2, no. 4, Aug.-Sept. 1960, p. 27-30.

13338* Economic Integration in the United Arab Republic: A Study in Resources Development. Discusses economic measures leading toward unification, supplementary and competitive aspects, problematic aspects of the merger, plans of economic development of the U. A. R. ***Ragaei El Mallakh.*** *Land Economics*, v. 36, no. 3, Aug. 1960, p. 252-265.

13339* Mathematical Methods of Organizing and Planning Production. The work was discussed at a meeting of the Mathematics Section of the Institute of Mathematics and Mechanics of the Leningrad State University, and was highly praised by mathematicians. In addition, a special meeting of industrial workers was called by the Directorate of the University at which the other aspect of the work—its practical application—was considered. Reproduces the contents of the report given at the meetings. Includes a presentation of the mathematical problems and an indication of those questions of organization and planning in the fields of industry, construction, transportation, and agriculture which lead to the formulation of these problems. ***L. V. Kantorovich.*** *Management Science*, v. 6, no. 4, July 1960, p. 366-422.

13340 World Population and World Resources. IV. The Earth's Capacity to Provide Food. The Dutch consume 2 tons grain equivalent per head per year—an amount which in the world's subsistence communities keeps six people alive. There is enough potential agricultural land on Earth to provide the Dutch standard for ten times its present population. ***Colin Clark.*** *New Scientist*, v. 8, Aug. 11, 1960, p. 411-413.

13341* The Economic Implications of Political Democracy. The Road to Economic Progress. Compared to many countries, and especially to the less-developed countries in Africa and Asia, South Africa is very favorably situated for economic advance. Since industry has been, and is likely to remain, the most general field of contact between White and Black, the author feels that a great responsibility rests on its leaders to maintain harmonious industrial relations. Non-Whites must be permitted and encouraged to graduate and play their full part at all levels in the country's economic life. ***Sheila T. Van Der Horst.*** *Optima* (Suppl.), June 1960, 50 pp.

13342 The European Engineer Talks. . . . on the common market, outer market, current design, research, education, plans, agreements, cartels, trusts. Presents excerpts from interviews of 10 to 15 key men in representative industries in France, Germany, Italy, Belgium, Great Britain, and Switzerland. ***E. J. Tangerman.*** *Product Engineering*, v. 31, no. 35, Aug. 29, 1960, p. 61-84.

13343 Our Squander of the World Market. Shows how increasing foreign imports in all fields are reducing domestic employment and sales in the U. S. *Steel*, v. 147, Sept. 5, 1960, p. 37-43.

13344* Current Economic Developments in Europe. Discusses the situation in business and industry in eastern Europe and the Soviet Union during the first quarter of 1960, followed by a similar treatment of western Europe. *United Nations, Economic Bulletin for Europe*, v. 12, no. 1, June 1960, p. 1-55 + 2 graphs.

See also: **13407** (statistics of cloud seeding); **13479** (gas-turbine economics).

FLUID MECHANICS

13345 Dynamics of Liquids in Moving Containers. The small motion of an ideal liquid in a fixed or moving rigid container of simple geometrical shape is known or can be approximated. The effects of viscous damping and of certain damping devices were studied. Reviews 142 papers. ***R. M. Cooper.*** *ARS Journal*, v. 30, Aug. 1960, p. 725-729.

13346* Liquid Flow Through Orifices, Flow Nozzles or Venturi Meters. ***F. Caplan.*** *Design News*, v. 15, Aug. 15, 1960, p. 96.

13347* Water Flow Analogues for Gas Dynamics. By using water models, with tracer particles in the water, considerable information can be obtained quickly, and at low cost. ***R. E. Morris and B. Haythornthwaite.*** *Engineering*, v. 190, Aug. 19, 1960, p. 261-263.

13348* Turbulent Boundary Layer on a Flat Plate in a Stream of Dissociating Gas. A theoretical solution of a turbulent boundary layer problem of dissociating gas on a flat plate. A half-empirical Prandtl-Kármán turbulent theory is used. ***S. I. Kosterin and Yu. A. Koshmarov.*** *International Journal of Heat and Mass Transfer*, v. 1, no. 1, June 1960, p. 46-49.

13349 Osmotic Pressure of Moderately Concentrated Polymer Solutions. By two methods, a linearization and a variational principle, the Born-Green-Kirkwood equation for the radial distribution function is solved approximately and the osmotic pressure of chain polymer solutions computed at arbitrary concentration. ***Marshall Fixman.*** *Journal of Chemical Physics*, v. 33, Aug. 1960, p. 370-381.

13350* The Flow of a Conducting Fluid Past a Magnetized Cylinder. ***J. D. Murray and Lan-Keh Chi.*** *Mathematika*, v. 7, pt. 1, no. 13, June 1960, p. 64-77.

13351 Some Measurements of the Elastic and Viscous Properties of Thixotropic Fluids. A coaxial cylinder viscometer for natural "wax-containing" oils. ***E. W. Billington.*** *Physical Society, Proceedings*, v. 76, pt. 1, July 1960, p. 127-136.

13352 Turbulence Theory and Functional Integration. I-II. Deals with an integral representation of the general solution to the Hopf equation. Proves that the integral representations for the Navier-Stokes spatial correlation functions satisfy the reality conditions, the continuity conditions, and the Navier-Stokes condition. ***Gerald Rosen.*** *Physics of Fluids*, v. 3, no. 4, July-Aug. 1960, p. 519-528.

13353 Flat Plate Drag in Magnetohydrodynamic Flow. ***H. P. Greenspan.*** *Physics of Fluids*, v. 3, no. 4, July-Aug. 1960, p. 581-587.

13354 Plasma Viscosity in a Magnetic Field. Analyzes the viscosity of a fully ionized plasma in a magnetic field from a consideration of particle orbits; and from the solution of a simplified Boltzmann equation. ***Allan N. Kaufman.*** *Physics of Fluids*, v. 3, no. 4, July-Aug. 1960, p. 610-616.

13355* Stability of Flow in a Rotating Viscous Incompressible Fluid Subjected to Differential Heating. Attempts to find a theoretical explanation for the type of flow observed when a liquid is subjected at the same time to rotation and to a horizontal temperature gradient. ***J. Brindley.*** *Royal Society of London, Philosophical Transactions*, v. 253, Ser. A. Mathematical and Physical Sciences, no. 1020, July 28, 1960, 25 pp.

13356 Theoretical Characteristics of Several Fluid-Metering Instruments. Investigates several configurations of a small instrument utilizing compressible and incompressible fluids to distinguish the dive speed of a vehicle traveling in water. Derives equations of motion and calculates the resulting fluid pressures for constant dive speeds of 5 and 20 feet per second. ***M. D. Bennett.*** *U. S. Atomic Energy Commission*, SC-4446(RR), Apr. 1960, 51 pp. (UF767 Un3.1sc Contin.)

13357 Behavior of Isolated Disturbances Superimposed on Laminar Flow in a Rectangular Pipe. Disturbance is produced by injecting a quantity of dye into the pipe 39 ft from the entrance. ***Grover C. Sherlin.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry*, v. 64A, no. 4, July-Aug. 1960, p. 281-289.

13358* Disturbances Due to the Motion of a Cylinder in a Two-Layer Liquid System. ***Lloyd H. Carpenter and Garbis H. Keulegan.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 64C, no. 3, July-Sept. 1960, p. 241-253.

13359 Viscoelasticity. Phenomenological Aspects. A symposium sponsored by the Armstrong Cork Co. held at its Research and Development Center, Lancaster, Pennsylvania. ***J. T. Bergen, editor.*** 150 pp. 1960. Academic Press, New York. (QA931 Ar58v)

FOOD TECHNOLOGY

13360* Food Composition Tables in the U.S.A. ***E. Neige Todhunter.*** *American Dietetic Association, Journal,* v. 37, Sept. 1960, p. 209-214.

13361* Nutritional Value of Fish Flour Supplements. An odorless, defatted fish flour, evaluated for its protein quality by the Mitchell-method, was found to have a biologic value of 88%. ***V. Chalam Metta.*** *American Dietetic Association, Journal,* v. 37, Sept. 1960, p. 234-240.

13362* Changes in Protein Extractability During Post-Rigor Tenderization of Chicken Breast Muscle. ***B. Weinberg and Dyson Rose.*** *Food Technology,* v. 14, Aug. 1960, p. 376-379.

13363* Irradiation Preservation of Pacific Northwest Fish. I. Cod Fillets. The optimum irradiation dose for cod fillets appeared to be 0.46 megarad or lower. Such irradiation increased the storage life of cod fillets at 32 to 35 F by three times. ***David T. Miyauchi.*** *Food Technology,* v. 14, Aug. 1960, p. 379-382.

13364* A Continuous Process for Dehydrating Honey. The product has color and flavor quite close to that of the original honey; has free-flowing, granular physical form; and has long shelf life. ***Victor A. Turkot, Roderick K. Eskew, and Joseph B. Claffey.*** *Food Technology,* v. 14, Aug. 1960, p. 387-390.

13365* The Utilization of Ionizing Radiation to Increase the Storage Life of White Potatoes. Although irradiated potatoes remained quite free from decay for extremely long periods when not subjected to excessive handling, limited cooking tests and other observations indicated that a gradual reduction in quality was taking place. ***M. Workman, M. E. Patterson, N. K. Ellis, and F. Heiligman.*** *Food Technology,* v. 14, Aug. 1960, p. 395-400.

13366* Interior Physical Quality and Bacterial Contamination of Market Eggs as Influenced by Egg Shell Permeability. ***Daniel Fromm and Robert J. Monroe.*** *Food Technology,* v. 14, Aug. 1960, p. 401-403.

13367* Role of Psychrophilic Bacteria in Frozen Food Spoilage. Demonstrates that once the enzymes of psychrophilic bacteria are elaborated and liberated in the growth menstrum, lowering the temperature will slow their action, but will not stop it, and definitely will not remedy damage already done. ***A. C. Peterson and M. F. Gunderson.*** *Food Technology,* v. 14, Sept. 1960, p. 413-417.

13368* Germicidal Effect of Orange Peel Oil and D-Limonene in Water and Orange Juice. I. Fungicidal Properties Against Yeast. Fungicidal effect of orange-peel oil and d-limonene (stripper oil) was determined against *Zygosaccharomyces major* in water and in single-strength orange juice at 25 C. Both oils exhibited lethal properties in water (pH 7.0) in concentrations as low as 0.02%, while in orange juice 0.1% was required. d-Limonene was more effective than orange-peel oil in both water and orange juice. ***D. I. Murdock and W. E. Allen.*** *Food Technology,* v. 14, Sept. 1960, p. 441-445.

13369* Studies on the Application of Infrared in Food Processing. Three types of high energy, infrared radiators—quartz lamps, quartz tubes, and calrods—were evaluated for their effectiveness in blanching apple tissue. General quality of infrared-blanched samples was better than that of samples blanched by conventional steam or boiling-water methods. ***E. A. Asselbergs, W. P. Mohr, and J. G. Kemp.*** *Food Technology,* v. 14, Sept. 1960, p. 449-453.

13370 Radiation Preservation of Food. Progress and Problems in Radiation Processing of Food. ***Walter M. Urbain.*** *Journal of Agricultural and Food Chemistry,* v. 8, Sept.-Oct. 1960, p. 340-342.

13371 Current Aspects of the Wholesomeness of Irradiated Food. Describes wholesomeness testing and undertakes an analysis of the pertinent data now available. Sixteen foods have been found to be grossly nontoxic to either rats or dogs. Further work is needed to elucidate the heart rupture observed in mice fed highly irradiated foods. Vitamins A, B_1, B_6, C, E, and K are susceptible to extensive radiation destruction. ***Merrill Stafford Read.*** *Journal of Agricultural and Food Chemistry,* v. 8, Sept.-Oct. 1960, p. 342-349.

13372 Commercialization Technology and Economics in Radiation Processing. Currently, low-energy source radiation (cobalt-60) is preferred over high-energy sources which potentially induce radioactivity. Presents design and description of radiation facilities for treatment of one or several products. ***H. F. Kraybill and D. C. Brunton.*** *Journal of Agricultural and Food Chemistry,* v. 8, Sept.-Oct. 1960, p. 349-356.

13373 Further Studies on the Nutritional Improvement of Rice. The proteins of whole and milled rice can be effectively supplemented by those of whole-milk solids, lactalbumin, and defatted whole egg. ***M. C. Kik.*** *Journal of Agricultural and Food Chemistry,* v. 8, Sept.-Oct. 1960, p. 380-382.

13374 Cystine Content of Proteins, Foods, and Feeds, Comparison of Chromatography on a Sulfonated Polystyrene Resin and Microbiological Methods of Determination. The microbiological procedures using 30-min hydrolysis gave higher values than the chromatographic method, but results were erratic. ***Robert John Evans, Selma L. Bandemer, and Doris H. Bauer.*** *Journal of Agricultural and Food Chemistry,* v. 8, Sept.-Oct. 1960, p. 383-386.

13375* Mass Algal Culture in Space Operations. System uses photosynthesis to regenerate O from exhaled carbon dioxide in sealed cabins in the absence of gravity. Discusses design considerations as to choice of algal strain, illumination, nutrients, and gas-exchange methods. ***Robert D. Gafford and D. D. Richardson.*** *Journal of Biochemical and Microbiological Technology and Engineering,* v. 2, no. 3, Sept. 1960, p. 299-311.

FUELS AND COMBUSTION

13376 Detonation Characteristics of Hydrogen-Oxygen Mixtures at High Initial Pressures. ***Roy L. Gealer and Stuart W. Churchill.*** *A.I.Ch.E. Journal,* v. 6, no. 3, Sept. 1960, p. 501-505.

13377 Flame Stabilization on a Porous Plate. Propane-air flames were observed over a free stream velocity range of 10 to 42 fps and a range of mass equivalence ratios for the injected mixture from 1.09 to 4.76. ***Alan Q. Eschenroeder.*** *ARS Journal,* v. 30, Aug. 1960, p. 754-758.

13378 Stability of Some Potential Rocket Fuels in the Molten State. ***R. P. Rastogi, R. K. Nigam, and Harbans Lal.*** *ARS Journal,* v. 30, Sept. 1960, p. 905-907.

13379 Tetramethyl Lead—An Antiknock Agent for Modern Gasolines. Presents engine performance data to demonstrate the efficacy of TML, and a discussion of the mechanism of the antiknock reaction. ***W. L. Richardson, M. R. Barusch, G. J. Kautsky, and R. E. Steinke.*** *American Chemical Society, Division of Petroleum Chemistry, General Papers, Preprints,* v. 5, no. 3, Aug. 1960, p. 37-47. (TP690 Am35g Vis.)

13380 Fluorine Solid Propellants. Gives several formulations of solid propellant. ***Milton Farber.*** *Astronautics,* v. 5, Aug. 1960, p. 34 + 2 pages.

13381 Missile Engineering—Rocketdyne Tests New Solid Propellants. ***Erwin J. Bulban.*** *Aviation Week,* v. 73, Aug. 8, 1960, p. 80-85.

13382* Unusual Lustrous Carbon Inclusions in Coke. Dark embedments in a large-scale production coke were identified by optical microscopy and electron microscopy and on the basis of their density as low-temperature lustrous C. A very thin coating of retort graphite on coke was detected by the fact that in-

stead of the coke cell walls formed, NaCl crystals served as precipitation surfaces for the C films from the gas phase. (*In German.*) Über ungewöhnliche Glanzkohlenstoff-Einlagerungen an Koks. ***Th. Nemetschek and M.-U. Otte.*** *Brennstoff-Chemie*, v. 41, no. 6, June 1960, p. 161-165.

13383* The Spontaneous Ignition Behavior of n-Heptane and i-Heptene-Ethyl Benzene Mixtures. This type of ignition was examined at a compression initial temperature of 175 C. A discrepancy exists in the difference in the combustion process during and after the compression of the mixture by ethyl benzene. In the two cases, there are delays of the step reaction due to ethyl benzene. (*In German.*) Das Selbstzündverhalten von n-Heptan- und i-Hepten-Äthylbenzol-Gemischen. ***Carl Kröger and Hubertus Queins.*** *Brennstoff-Chemie*, v. 41, no. 6, June 1960, p. 181-183.

13384 Automated Determination of Mechanical Properties of Coke. The method is based on tumbler test and ratio of yield of sizes +60 mm. to −60 mm. Gives details on testing set-up and procedure. ***G. N. Dmitriev and G. I. Enik.*** *Henry Brutcher Translation No.* 4813, 3 pp. (From *Izvest. Akad. Nauk SSSR, OTN, Met. i Topl.*, no. 1, 1960, p. 174-175.) Henry Brutcher, Altadena, Calif.

13385* Coal Gasification—Sumitomo Process. Keys to new process are ferrous oxide flux and vertically-rising vortex entrainment. ***Toshio Taniyama and Yoshiichi Karato.*** *Chemical Engineering Progress*, v. 56, Aug. 1960, p. 66-70.

13386* Coal Chemistry in Germany. Coal is used as such or in the form of derivatives resulting from dry distillation. In iron metallurgy, coke is used for ore reduction. Dye and pharmaceutical industries use the aromatic derivatives of coal tar from which detergents and plastic materials also are obtained. Coke serves as a basis for the synthesis of calcium carbide, acetylene and calcium cyanamide. The synthesis of methanol, the Fischer-Tropsch and Oxo syntheses were mentioned. (*In French.*) La carbochimie en Allemagne. ***H. W. Knauff.*** *Chimie & Industrie*, v. 84, no. 1, July 1960, p. 3-19.

13387* The Removal of Carbon Monoxide From Town Gases. Removal of CO from fuel gases used in formulating town gas by converting it at near atmospheric pressure to CO_2 and the equivalent volume of H by means of the water gas shift reaction is an eminently practicable and suitable process. ***H. D. Edwards.*** *Coke and Gas*, v. 22, Aug. 1960, p. 331-336.

13388* The Relationships of the Properties of Coals With Those of Their Cokes. *N. C. Sinha, et al.* *Coke and Gas*, v. 22, Sept. 1960, p. 382-388.

13389* The Propagation of Waves in a Partially Ionized Medium. The equation of propagation of the plane waves was developed in the case where the magnetic field is longitudinal. The transversal and longitudinal modes then are decoupled. Each one successively is studied for the low frequencies. The propagation velocity of their coefficient of intensity reduction are determined. (*In French.*) Sur la propagation des ondes dans un milieu partiellement ionisé. ***Annie Baglin.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 5, Aug. 1, 1960, p. 684-685.

13390* Tailored Diesel Fuel. Why? Introduction of a new No. 2 diesel fuel made especially and exclusively for high-speed diesels brings up some questions. Here's why. *Diesel Power*, v. 38, Sept. 1960, p. 87-88.

13391* Comparison of Reactivity Measurements of Coke. Differences in test methods were discussed from the point of view of the kinetics of reaction. Results of measurements offered satisfactory correlation. A compound method was suggested. Sixty-seven coke specimens were used in a semi-industrial furnace. The reactivity is first influenced by the terminal temperature of the coke. (*In German.*) Vergleich von Reaktionsfähigkeitsmessungen an Koks. ***Werner Peters.*** *Glückauf; Bergmännische Zeitschrift*, v. 96, no. 16, July 30, 1960, p. 997-1006.

13392 Flames and Furnaces. Combustion of Pulverized Fuel. *M. W. Thring.* *Iron & Steel*, v. 33, no. 10, Sept. 1960, p. 463-467.

13393* Kinetics of Coal Carbonization Reactions in the Plastic State. Study of the activation energies of the reaction in the case of noncaking coal has yielded some information on the possible mechanism of coke formation. ***S. Sarkar, S. C. Biswas, and A. Lahiri.*** *Journal of Scientific & Industrial Research*, v. 19B, July 1960, p. 246-248.

13394* Selective Preparation of Coal. Physical and chemical composition of coal; waste material in coal; preparation. ***Parke O. Yingst.*** *Mines Magazine*, v. 50, Aug. 1960, p. 10-13.

13395* The Washing Cyclone—An Efficient Tool for Fine Coal Preparation. *J. P. Matoney.* *Mining Congress Journal*, v. 46, Aug. 1960, p. 44-49.

13396* Some Solid Propellant Developments. I. Ammonium nitrate makes up most of the grain of this compact solid-propellant gas generator used to drive the hydraulic system turbine on Tartar and Terrier. ***Alfred J. Zaehringer.*** *Missile Design & Development*, v. 6, Sept. 1960, p. 24-26.

13397 The Pre-Flame and Ignition Properties of Fuels. *K. C. Salooja.* *New Scientist*, v. 8, Sept. 15, 1960, p. 729-732.

13398 Hydrazine From Irradiation of Solid and Liquid Ammonia. *Boris Levy, Lawrence M. Epstein, and George Handler.* *Nucleonics*, v. 18, Sept. 1960, p. 128 + 1 page.

13399 Missile and Space Propulsion Systems. Liquid F-liquid H gives highest specific thrust system. Liquid O-liquid H is close contender. ***Edward L. McCandless.*** *SAE Journal*, v. 68, Sept. 1960, p. 64-65.

13400 Plant Performance Tests of the Tromp Dense-Medium Coal-Cleaning Process. Reports performance of various types of coal-cleaning equipment; other reports are listed. ***M. R. Geer, Michael Sokaski, and H. F. Yancey.*** *U. S. Bureau of Mines Report of Investigations* 5619, 1960, 34 pp. (TN21 Un3r Room 290)

13401 A Study of the Combustion of Aluminum Borohydride in a Small Supersonic Wind Tunnel. Combustion in the Mach 2 airstream of a wind tunnel was studied by analyzing gas samples from the airstream. ***Harrison Allen, Jr. and Edward A. Fletcher.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-296*, July 1960, 15 pp. (TL570 Un3t Room 290)

13402 Ignition of a Combustible Atmosphere by Incandescent Carbon Wear Particles. Fires were produced by incandescent C wear particles obtained at conditions of electric potential as low as 106 volts and 0.3 ampere at 400 F. Ignitions were obtained only with C wear particles produced with an electric potential across the carbon-vane - disk interface. ***Donald H. Buckley, Max A. Swikert, and Robert L. Johnson.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-289*, Sept. 1960, 16 pp. (TL570 Un3t Room 290)

13403 Liquid-Phase Heat-Release Rates of the Systems Hydrazine-Nitric Acid and Unsymmetrical Dimethylhydrazine-Nitric Acid. *Dezso Somogyi and Charles E. Feiler.* *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-469*, Sept. 1960, 16 pp. (TL570 Un3t Room 290)

13404* The Kinetics of the Reactions Between Oxygen and Carbon, and Their Significance for High-Speed Gasification. (*In German.*) Die Kinetik der Reaktionen zwischen Sauerstoff und Kohlenstoff sowie ihre Bedeutung für die Schnellvergasung. ***Siegfried Bielack.*** *VDI Zeitschrift*, v. 102, no. 22, Aug. 1, 1960, p. 1071-1072.

See also: **13907** (solid propellants); **13908** (polyurethane propellants).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

13405* Study of Snow-Melt Process by Means of Radioisotopes. Work started in 1957 in the Zagorsk region of the Moscow area on a complex investigation of the problem of the heat and water regime of the Earth's surface. The influence of agricultural-technical measures on the run-off of water is a part of the investigated problem. The applied method proved

successful. (*In Russian.*) Issledovanie snegotaianiia metodom radioaktivnykh izotopov. ***Iu. N. Agashkin.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Geograficheskaia,* 1960, no. 4, July-Aug., p. 117-121.

13406 The Common Ground of Meteorology and Hydrology. Survey of topics of mutual interest in hydrology and meteorology intended primarily for the members of these two professions whose special interests are somewhat removed from the common ground. ***Ray K. Linsley.*** *American Meteorological Society, Bulletin,* v. 41, Aug. 1960, p. 423-428.

13407* Statistical Evaluation of Cloud Seeding Operations. ***K. A. Brownlee.*** *American Statistical Association, Journal,* v. 55, no. 291, Sept. 1960, p. 446-453.

13408* A Theory of Ionization of Meteor Trails. II. The Role of Ionizing Phenomena on the Surface of a Meteor Body in the Ionization Effect of a Meteor Trial. (*In Russian.*) K teorii ionizatsii meteornykh sledov. II. Rol' ionizatsionnykh iavlenīĭ na poverkhnosti meteornogo tela v effekte ionizatsii meteornogo sleda. ***A. M. Furman.*** *Astronomicheskīĭ Zhurnal,* v. 37, no. 4, July-Aug. 1960, p. 746-752.

13409* Concentration of Particulate Air-Borne Fission Products at Ground Level in Canada During I.G.Y. *J. L. Wolfson and F. Terentiuk.* *Canadian Journal of Physics,* v. 38, Aug. 1960, p. 991-1010.

13410* Determination of Bottom Hole Pressure in a Flowing Gas Well. Method shows that a plot of flowing pressure vs. depth for a gas well can be represented as a series of incremental straight lines, with the accuracy increasing as the number of increments increase. ***Sharanjit S. Dhillonn and Frank W. Cole.*** *Canadian Mining and Metallurgical Bulletin,* v. 53, no. 580, Aug. 1960, p. 623-628; *Canadian Institute of Mining and Metallurgy, Transactions,* v. 63, 1960, p. 415-420.

13411* Nuclear Geophysics in Prospecting for Ore and Coal Deposits. After examining the possible methods of preparing sources based on the Sr-90 radioisotope, a melted vitreous preparation based on $SrO \cdot B_2O_3$ was used. The possibility of varying the activity up to 12.5 curies/g guarantees the conditions necessary to obtain sources of ionizing radiations whose activity on the unit of surface can vary from 1 mcurie/cm^2 of the surface of radiation to 1.5 curie/cm^2 with a layer thickness of 0.1-0.5 mm. The prerequisites for applying density and selectivity logging and the practical results obtained with radioactive logging on ore and coal deposits with Fe, Cu, bauxite, B, Be and Mn were examined. (*In Russian.*) Iadernaia geofizika pri razvedke rudnykh i ugol'nykh mestorozhdenīĭ. ***Iu. P. Bulashevich, G. M. Voskoboinikov, and L. V. Muziukin.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 20 pp. (QC770 C76pr)

13412* Tritium in Underground Water Studies. Examining the industrial research materials and the use of equipment for recording tritium in labeled and natural waters proved that the method of control for the exploitation of a deposit by injecting labeled water in a stratum, combined with the natural tritium method, widens the interval of the control period to some ten years. This method can be very effective in increasing the efficiency of petroleum extraction. The value of the tritium-petroleum ratio can be used successfully in studying the directions of underground waters, in determining the connection between the ground waters and the deep seated waters, and in solving other hydrogeological and hydrodynamic problems. (*In Russian.*) Tritii v issledovanii podzemnykh vod. ***F. A. Alekseev, et al.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 15 pp. (QC770 C76pr)

13413* Sunspot Activity Correlates With Pipeline Voltages. A study of sunspot activity on July 14-15, 1959. *Corrosion,* v. 16, Aug. 1960, p. 28.

13414* Micro-Organisms as Indicators of Hydrological Phenomena in Seas and Oceans. II. Investigation of the Deep Circulation of the Indian Ocean Using Microbiological Methods. The microbiological investigations of the Indian Ocean water masses at 61 stations along the sections between Africa and Antarctic, the Antarctic and Asia, showed that Antarctic waters are characterized by low concentrations of heterotrophs, whereas the equatorial-tropical waters are characterized by high concentrations of these micro-organisms. ***A. E. Kriss, M. N. Lebedeva, and I. N. Mitzkevich.*** *Deep-Sea Research,* v. 6, no. 3, Apr. 1960, p. 173-183.

13415* Farming the Sea. Full exploitation of the vast resources of the sea requires the control of all nutrients and of the feeding, breeding, and migration of all marine creatures. The development of the fisheries for plankton-feeding animals offers a short-term gain. ***A. J. Southward.*** *Discovery,* v. 21, Aug. 1960, p. 330-337.

13416 Dynamics of Climate. Proceedings consider the problems involved in studying the general circulation of the earth's atmosphere by the numerical integration of suitable mathematical models. ***Richard L. Pfeffer, editor.*** 137 pp. Pergamon Press, New York. (QC981 C76d)

13417 The Exploration of the Solar System. The assembly orbit, the Moon, Venus, Mars, further possibilities are discussed. Notes on celestial dynamics are cited. ***Felix Godwin.*** 200 pp. 1960. Plenum Press, Inc., New York. (TL789 G54e)

13418 Direct Recording of Wind Slip. Methods of recording directly the relation of two wind speeds, as a difference, or a ratio are outlined. ***Ronald L. Ives.*** *Franklin Institute, Journal,* v. 270, no. 3, Sept. 1960, p. 163-174.

13419 Frontiers of the Sea. The Story of Oceanographic Exploration. Discusses exploring the hinterland, the unseen landscape, probing the deep-sea floor, patterns of the waters, the great heat engine, the range of ocean life, the promise of plenty, and the new oceanography. ***Robert C. Cowen.*** 307 pp. 1960. Doubleday & Company, Garden City, N. Y. (GC11 C83.8f)

13420* The Record in the Meteorites. I. The Former Environment of Stone Meteorites as Deduced From K^{40}-Ar^{40} Ages. ***G. G. Goles, R. A. Fish, and E. Anders.*** *Geochimica et Cosmochimica Acta,* v. 19, no. 3, 1960, p. 177-195.

13421* Symposium on the Geochemistry of Petroleum. Presents papers from the General Petroleum Geochemistry Symposium, which was held on June 4, 1949, during the Fifth World Petroleum Congress, at Fordham University in New York. Encompasses bacteriology, soil science, organic chemistry, oceanography, and clay mineralogy. ***Bartholomew Nagy, editor.*** *Geochemica et Cosmochimica Acta,* v. 19, no. 4, Aug. 1960, p. 235-317.

13422* Geographical Aspects of Cosmic-Ray Studies. ***Serge A. Korff.*** *Geographical Review,* v. 50, no. 4, Oct. 1960, p. 504-522.

13423* Use of Reflection-Seismic Methods in the Exploration of Deep Beds. ***G. Dohr.*** *International Geology Review,* v. 2, July 1960, p. 617-622.

13424* World-Wide Effects of Hydromagnetic Waves Due to Argus. The Argus detonations in the ionosphere above the South Atlantic produced geomagnetic disturbances that propagated to almost all parts of the world. ***W. K. Berthold, A. K. Harris, and H. J. Hope.*** *Journal of Geophysical Research,* v. 65, no. 8, Aug. 1960, p. 2233-2239.

13425* Some Geochemical Aspects of the Mohorovicic Discontinuity. Geological evidence indicates that the upper mantle is of peridotitic composition. Though conditions for eclogite stability do exist within the earth, there is no evidence for the hypothesis that the Mohorovicic discontinuity coincides with a phase transformation to eclogite. ***P. G. Harris and J. A. Rowell.*** *Journal of Geophysical Research,* v. 65, no. 8, Aug. 1960, p. 2443-2459.

13426* Symposium on the Exosphere and Upper *F* Region. Compilation of 15 papers discussing the properties and physical characteristics of the Earth's atmosphere. *Journal of Geophysical Research,* v. 65, no. 9, Sept. 1960, p. 2563-2636.

13427* Horizontal Movement in the Earth's Crust. New method of analysis is presented. Will indicate small displacements which may occur along fault lines in an area of seismic

activity. ***C. A. Whitten.*** *Journal of Geophysical Research*, v. 65, no. 9, Sept. 1960, p. 2839-2844.

13428* Sub-Bottom Reflection Measurements on the Continental Shelf, Bermuda Banks, West Indies Arc, and in the West Atlantic Basins. ***John Ewing, Bernard Luskin, Archie Roberts, and Julius Hirshman.*** *Journal of Geophysical Research*, v. 65, no. 9, Sept. 1960, p. 2849-2859.

13429* Nuclear Magnetism Logging. Theory of new logging method which is based on measurement of nuclear magnetism of formation fluids. Operates well in oil-base and water-base muds and empty holes, and can be used in all kinds of formations except strongly magnetic ones. ***R. J. S. Brown and B. W. Gamson.*** *Journal of Petroleum Technology*, v. 12; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 219, Aug. 1960, p. 201-209.

13430* A New Organic Fluid-Loss-Control Additive for Oilwell Cements. Provides greater fill-up behind pipe, even in highly porous formations. ***C. M. Stout and W. W. Wahl.*** *Journal of Petroleum Technology*, v. 12, Sept. 1960, p. 20-24.

13431* Chemical Stabilization of Sand. II. Use of Silica Gel for Stabilizing Sandy Foundations. ***H. L. Uppal, C. L. Dhawan, J. C. Bahri, and B. Verma.*** *Journal of Scientific & Industrial Research*, v. 19A, July 1960, p. 317-320.

13432* Collected Mineralogical Articles. Discusses the crystal chemistry of In, phasic correlation in the system nepheline-calcilite-anortite-silicon, manganese tourmalines, the role of metasomatism in the formation of alkali rocks, a native tetrahydrated sulfate of magnesium. Several articles are of local interest, like basalts in Western Volhynia, clays of the Odessa coast of the Black Sea, wehrlite from the Transcarpathians. (*In Russian.*) Mineralogicheskiĭ sbornik. ***E. K. Lazarenko, editor.*** *Mineralogicheskii Sbornik*, no. 13, 1959, 475 pp.

13433* Philex Open Pit Cut From Steep Philippine Canyon. Copper-gold ore in highly shattered andesite and blocky diorite is mined from a series of high benches. Ore breaks along fracture planes to small size for easy handling. *Mining World*, v. 22, no. 11, Oct. 1960, p. 50-52.

13434 Electromagnetic Standing Waves and Ball Lightning. ***Lewi Tonks.*** *Nature*, v. 187, Sept. 17, 1960, p. 1013-1014.

13435 The World's Water: A Squandered Asset. ***F. T. K. Pentelow.*** *New Scientist*, v. 8, Sept. 1, 1960, p. 587-588.

13436 How Californians Operate Their Water Floods. Describes current operating procedure in California floods. *Oil and Gas Journal*, v. 58, no. 34, Aug. 22, 1960, p. 73-76.

13437 Electromagnetic Signals From Nuclear Explosions in Outer Space. A burst of thermal X-rays, equivalent in energy to 1 ton of high explosive, produces a detectable 10-Mc/sec signal at a range of 1 km. The power in the electromagnetic signal varies as the square of the electron density, so this effect may provide a sensitive measure of the density of electrons in outer space. ***Montgomery H. Johnson and Bernard A. Lippmann.*** *Physical Review*, v. 119, 2nd ser., no. 3, Aug. 1, 1960, p. 827-828.

13438* Stress History of the Moon. The character of the lunar surface indicates that surface faulting has not been an important mechanism for the build-up of the lunar surface. If the radioactive content of the Moon is of the same order as that of chondritic meteorites, then the absence of major surface faults can be explained in a number of ways. ***G. J. F. MacDonald.*** *Planetary and Space Science*, v. 2, no. 4, Aug. 1960, p. 249-255.

13439* Radiation Belts About the Earth. (*In Russian.*) Vneshniĭ radiatsionnyĭ poias zemli. ***S. A. Slavatinsky.*** *Priroda*, v. 49, no. 7, July 1960, p. 3-6.

13440 A Conservative Estimate of the Meteoroid Penetrating Flux. ***R. L. Bjork.*** *Rand Corporation, Report* P-1913, Feb. 11, 1960, 11 pp. (T13 R15r Contin.)

13441* Determination of the Beneficiation Capacity of Coals According to Their Petrographic Characteristics. Evaluation of the concentration capacity of coals, carried out by the usual testing of average specimens and by their microscopic investigation, gives comparable results in studying the quality of coals during geological prospecting. (*In Russian.*) Opredelenie obogatimosti ugleĭ po petrograficheskim osobennostiam. ***I. I. Ammosov and V. K. Prianishnikov.*** *Razvedka i Okhrana Nedr*, v. 26, no. 7, July 1960, p. 10-15.

13442 The Physical Constants of Sea Ice. Presents in tables and graphs, basic properties of sea ice; the apparently erratic behavior is caused by precipitation of cryohydrates. ***Don L. Anderson.*** *Research Applied in Industry*, v. 13, Aug. 1960, p. 310-318.

13443* Science in Space. Chapter IV. The Moon. Chemical composition; the irregular shape of the Moon; the interior of the Moon; moonquakes and tidal effects. ***Harold C. Urey.*** 10 pp. 1960. National Academy of Sciences, Washington, D. C. (QB501 N21.7s Over.)

13444* Aeration Zone Water Behavior and Ground Waters of Arid Regions. The ground water intake in arid regions takes place by a concentrated water infiltration from periodical and constant surface water flows. For the fresh ground water formation the following conditions are necessary: the existence of a near-by intake area (surface drainage), the presence of permeable rocks and structural-tectonic and erosional dissection. (*In Russian.*) Nekotorye voprosy rezhima zony aeratsii i gruntovye vody zasushlivykh oblastei. ***A. A. Alexin.*** *Sovetskaia Geologiia*, v. 3, no. 7, July 1960, p. 95-102.

13445* On the Metallogenic 1:5,000,000 Map of the USSR. Principles of compilation of the first general metallogenic map of the USSR. (*In Russian.*) O metallogenicheskoĭ karte SSSR masshtaba 1:5 000 000. ***A. I. Semenov, G. S. Labazin, V. G. Grushevoĭ, and P. M. Tatarinov.*** *Sovetskaia Geologiia*, v. 3, no. 8, Aug. 1960, p. 3-25.

13446 Key to ASW Design: The Ocean's Thermal Structure. Discusses the effect of the ocean's thermal structure on antisubmarine warfare. ***C. O. Iselin and W. S. Richardson.*** *Space/Aeronautics, Research & Development Handbook*, v. 4, 1960-1961, p. L5-L11.

13447* The Oceanographic Research Vessel "H. U. Sverdrup". Concerns the new vessel placed this summer at the disposal of the Norwegian Defense Research Establishment. The principal data for the ship are given and the general arrangement is discussed. Describes deck machinery and equipment; discusses the laboratories and their instrumentation, and the electronic and electrical equipment on board. (*In Norwegian.*) Oseanografisk forskningsfartøy "H. U. Sverdrup". ***I. Engelsen.*** *Teknisk Ukeblad*, v. 107, no. 26, June 30, 1960, p. 561-565.

13448* On Critical Regimes and Horizontal Concentration of Momentum in Ocean Currents With Two-Layered System. ***Takashi Ichiye.*** *Tellus*, v. 12, no. 2, May 1960, p. 149-158.

13449* The Oceanography Challenge. A review. ***E. E. Halmos, Jr.*** *Underwater Engineering*, v. 1, no. 1, 1960, p. 51-53.

13450 Mobile and Portable Units for Geochemical Exploration for Uranium. A portable geochemical kit equipped for extracting U from water samples and measuring the pH and conductivity of the water on the spot. ***C. T. Illsley and R. L. Kinnaman.*** *U. S. Atomic Energy Commission, RME*-131, July 1959, 27 pp. (TN21 Un3.1r Contin.)

13451* ELF Electric Fields From Thunderstorms. Calculated field variations produced by an assumed typical cloud to ground discharge model are found to agree well with observed fields. ***A. D. Watt.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 64D, no. 5, Sept.-Oct. 1960, p. 425-433.

13452 Inventory of Washington Minerals. I. Nonmetallic Minerals. v. 1. Text. v. 2. Maps. ***Grant M. Valentine.*** *Washington (State), Division of Mines and Geology, Bulletin No.* 37, pt. 1, 1960, v. 1, 175 pp.; v. 2, 83 pp. (QE175 W27b Vis.)

13453* Tiros I Concludes Mission; Tiros II Readied. Includes 14 of the more than 23,000 pictures transmitted back to earth. *Weatherwise*, v. 13, no. 4, Aug. 1960, p. 158 + 4 pages.

13454* How to Use the Continuous Velocity Logger in Core and Shot Holes. Efficiency boosted; seismic geologic work combined through use of shallow velocity data. ***H. W. Hardy.*** *World Oil*, 1960, Oct., p. 160 + 5 pages.

See also: **13067** (foam for mine fire control).

GRAPHIC ARTS

13455* Multiflash Photography. ***Harold E. Edgerton and Frederick E. Barstow.*** *Industrial Photography*, v. 9, Aug. 1960, p. 20 + 2 pages.

13456* Multilens Camera Hypos Research. Hooking together three complete 35mm camera assemblies gives the Navy a valuable tool. ***Donald E. Witten.*** *Industrial Photography*, v. 9, Aug. 1960, p. 40 + 3 pages.

13457* How to Make Deep-Etch, Copperized Aluminum Plates for Offset Presses. ***Charles W. Latham.*** *Inland and American Printer and Lithographer*, v. 145, no. 6, Sept. 1960, p. 62 + 2 pages.

13458* Two-Colour Projection Phenomena. Two-color projection of the kind demonstrated by E. H. Land is described in relation to earlier processes. Discusses conditions necessary for the appearance of the surprisingly wide range of color and shows that these can be produced without recourse to "natural image situations". The influence of a number of factors is demonstrated. Also shows that the modern concept of adaptation, together with the known ambiguities of foveal vision, is sufficient to account for all these effects. The inherent limitations of the two-color method are demonstrated and the possibilities of two-color and three-color methods are compared. Some aspects of Land's theory are discussed and an evaluation of his work is attempted. ***M. H. Wilson and R. W. Brocklebank.*** *Journal of Photographic Science*, v. 8, no. 4, July-Aug. 1960, p. 141-150.

13459 Manual of Photographic Interpretation. Discusses: development of photo interpretation, procurement of aerial photography, fundamentals of photo interpretation, photo interpretation in geology, photo interpretation of soils, in engineering, forestry, wildlife management, range management, hydrology and watershed management, agriculture, urban area analysis, archaeology, geography, special forms of photo interpretation. 868 pp. 1960. American Society of Photogrammetry, Washington 5, D. C. (TR810 Am35m)

13460* Basic Color Theory for Photo-Mechanical Reproduction. Better and cheaper color printing and lithography is on the way, much of the progress being due to technical applications of photography and electronics. Discusses measurement of color, color and light relationships, radiant energy, and primary colors. ***Tom E. Buck.*** *ODR Reproductions Review*, v. 10, July 1960, p. 9 + 3 pages.

13461* Technology and Importance of Photographic Gelatine. III. Gelatine is most suitable for photographic purposes when it contains very small quantities of certain substances being essential for emulsification. (*In German.*) III. Technologie und Bedeutung der Photogelatine. ***Wolf S. Wittenberg.*** *Photo-Technik und-Wirtschaft*, v. 11, Aug. 1960, p. 279-282.

13462 Plastics and Photography. A short article on the use of plastics in photography. ***H. P. Zade.*** *Plastics (London)*, v. 25, July 1960, p. 263-264.

13463 Rapid-Starting High-Speed Cameras. Two rapid-starting high-speed cameras were designed to record rapid phenomena occurring at random. Discusses the novel film-transport system employed in these cameras, as well as associated triggering, timing and lighting equipment. ***W. O. S. Johnson.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, July 1960, p. 485-488.

13464 The Development of the Zoom Lens. Zoom or varifocal lenses have been known since 1930, but they were seldom used. After the second war they became generally applied to television cameras. Either mechanically or optically compensated, they necessarily contain many lens elements. ***Rudolf Kingslake.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, Aug. 1960, p. 534-544.

13465* Research of Photographic Image Quality Change in Printing Process. Measuring the sharpness of pictures showed that this sharpness decreases during printing. Sharpness decrease is much smaller than resolution decrease. (*In Russian.*) Issledovanie izmeneniia kachestva fotograficheskogo izobrazheniia v protsesse pechati. ***I. B. Bliumberg, T. M. Ziazina and G. I. Teregulov.*** *Tekhnika Kino i Televideniia*, 1960, no. 7, July, p. 10-18.

13466* Formation, Structure and Functions of Foreign Centers in Emulsion Microcrystals. The relationship between the foreign spectral absorption and the kinetics of the total and spectral photosensitivity of photographic emulsions in the digestion process was studied. The similarity of the curves representing the dependency of the foreign absorption intensity for different wavelengths on the digestion time was shown. The presence of three types of foreign Ag centers in emulsion microcrystals was suggested. (*In German.*) Bildung, Aufbau und Funktionen von Fremdzentren in Emulsionsmikrokristallen. ***Sh. L. Broun, B. G. Warschawer, and K. W. Tschibissow.*** *Zeitschrift für Wissenschaftliche Photographie, Photophysik und Photochemie*, v. 54, nos. 1-3, June 1960, p. 25-37.

HEAT POWER

13467 Experimental Studies With Small-Scale Ion Motors. Cesium surface ionization ion sources were operated in ion motor configurations. ***C. R. Dulgeroff, R. C. Speiser, and A. T. Forrester.*** *ARS Journal*, v. 30, Aug. 1960, p. 761-763.

13468 Application of Air-Breathing Jet Engines to High Mach Number Vehicles. Discusses the future of the jet engine. ***M. Arens.*** *Aero/Space Engineering*, v. 19, Aug. 1960, p. 26 + 6 pages.

13469 Cryogenic Hydrogen Progress. Vacuum firings of Centaur engines highlight liquid H_2 rocket-tests at Pratt & Whitney; materials technology, and handling techniques evolve. ***John P. Kushnerick.*** *Aircraft and Missiles*, v. 3, Oct. 1960, p. 17-19.

13470* New Methods of Generating Electricity From Gas Sources. I. Thermoelectric Effects. Systems used are Seebeck generators and Peltier cooling and heating. ***C. G. von Fredersdorff.*** *American Gas Journal*, v. 187, Aug. 1960, p. 12-17.

13471* Gas-Turbines—Present and Future Developments. Marine uses only are considered. ***Robert S. Lucas.*** *American Society of Naval Engineers, Journal*, v. 72, no. 3, Aug. 1960, p. 539-543.

13472 The Prospects of MHD Power Generation. Applications await answers to major questions about magnetohydrodynamic phenomena, and fruitful inventions. ***Leo Steg and George W. Sutton.*** *Astronautics*, v. 5, Aug. 1960, p. 22 + 8 pages.

13473 The E-D Nozzle. Tests confirm that the expansion-deflection type nozzle's novel design brings both reduced size and weight and improved thrust performance at low altitudes. ***G. V. R. Rao.*** *Astronautics*, v. 5, Sept. 1960, p. 28 + 3 pages.

13474* On the Coefficient of Heat Transfer Between Gases and Cylinder Walls of the Spark-Ignition Engine. Test engine used is a four stroke spark-ignition engine with a water cooled single cylinder. ***Tatsu Oguri.*** *Bulletin of JSME*, v. 3, no. 11, Aug. 1960, p. 363-369.

13475* The By-Pass Engine. The experience of by-pass engine development shows that the advantages can be increased by operating at higher flame temperatures. This has led to the development of efficient blade-cooling systems and to satisfactory manufacturing techniques for air-cooled blades. ***A. G. Newton.*** *Canadian Aeronautical Journal*, v. 6, no. 7, Sept. 1960, p. 257-260.

13476* Materials Problems Associated With Uncooled Rocket Nozzles. Thermal shock, erosion, and catastrophic corrosion problems related to the above with solid fuels. ***Jesse D. Walton, Jr. and C. R. Mason, Jr.*** *Corrosion*, v. 16, Aug. 1960, p. 77-80.

13477 Energies of the Universe. Popularized account of natural phenomena as understood by modern science. Facts and figures shown to support the view that the education of today's scientists is in many instances based on misconceptions, and is now obsolete. ***Eugene Fritz.*** 124 pp. 1960. Philosophical Library, New York. (QC73 F91e)

13478* British Missile and Rocket Engines. Reference list of successful work done in Britain. ***G. V. E. Thompson.*** *Engineering*, v. 190, Sept. 2, 1960, p. 322-323.

13479* The Economics of an Industrial Gas Turbine. Discusses use of the small-size gas turbine as a source of peak electrical power in conjunction with purchased and steam-generated power in the industrial installation. ***David Panar.*** *Engineering Journal*, v. 43, Aug. 1960, p. 59-63.

13480 Fuel Cells. Contains papers of the symposium held by the Gas and Fuel Chemistry Division of the American Chemical Society at the 36th National Meeting in Atlantic City, Sept., 1959. Discusses H-O (air) fuel cell with carbon electrodes; catalysis of fuel-cell electrode reactions; electrode kinetics of low-temperature H-O fuel cells; higher-pressure H-O fuel cells; high-temperature fuel cells. ***G. J. Young, editor.*** 154 pp. 1960. Reinhold Publishing Corp., New York. (TK1041 Am35.3f)

13481* The Development of Multi-Fuel Engines. Development work was carried out on four-stroke open-chamber multi-fuel engines derived from the Thornycroft range, the KRN6, the QR6, and the JR6. Gives details of the largest of these engines, the 11·3-litre KRN6. ***G. K. Martlew.*** *Gas and Oil Power*, v. 55, no. 666, July 1960, p. 183-186.

13482* A Thermal Energy Storage System for Solar Powered Earth Satellite Power Plants. ***Curtis L. Walker and James D. Matchett.*** *General Motors Engineering Journal*, v. 7, no. 3, July-Aug.-Sept. 1960, p. 10-12.

13483 Power Sources Designed for Space. Describes conversion systems employing chemical, solar and nuclear energies and discusses their prospects for further improvement. ***W. Shorr, D. Linden, and A. F. Daniel.*** *IRE Transactions on Military Electronics*, v. MIL-4, nos. 2-3, Apr.-July 1960, p. 313-316. (TK1 In6.6mi Vis.)

13484 Plastics as Heat Insulators in Rocket Motors. Analytical methods used for predicting the performance of plastic insulation materials in the high-temperature environments of rocket chambers. ***Walter C. Hourt.*** *Industrial and Engineering Chemistry*, v. 52, Sept. 1960, p. 761-763.

13485 Plastics for Rocket Motor Nozzles. ***George Epstein and Harry A. King.*** *Industrial and Engineering Chemistry*, v. 52, Sept. 1960, p. 764-767.

13486 An Introduction to the Free-Piston Engine. Serves as an introduction of this significant development whose early performance suggests that indeed it may well replace the diesel engine and the gas turbine in a wide variety of applications. ***R. M. Hosie and K. A. Troth.*** *Institute of Petroleum Review*, v. 14, Sept. 1960, p. 281-287.

13487 Direct Energy Conversion. Solar cells; thermoelectricity; thermionic emission; fuel cells. ***Paul H. Egli.*** *Journal of Metals*, v. 12, Aug. 1960, p. 615-619.

13488 Energy Conversion Processes. Progress report on developments in three methods: thermoelectric, thermionic, photovoltaic. ***Geoffry W. Wilson.*** *Machine Design*, v. 32, Aug. 18, 1960, p. 189 + 2 pages.

13489 Direct Conversion in Fuel Assemblies. Thermionic and thermoelectric generator was built into a nuclear fuel assembly and inserted into a reactor to produce electricity. *Mechanical Engineering*, v. 82, Aug. 1960, p. 68.

13490* New Methods of Generating Electric Power—Thermoelectricity. Applying the Seebeck effect to power generation. ***Stephen J. Angello.*** *Mechanical World and Engineering Record*, v. 140, Sept. 1960, p. 369-371.

13491 Solar Mechanical Engine to Give 15 KW. Development of a system to run a full year; later potential may be enormous. ***Charles D. LaFond.*** *Missiles and Rockets*, v. 7, no. 7, Aug. 15, 1960, p. 24 + 2 pages.

13492 Versatile Gas Turbines: Lightweight Power. Device makes a bid to become prime mover in missile/space GSE market. ***W. W. West and C. R. Phaneuf.*** *Missiles and Rockets*, v. 7, no. 12, Sept. 19, 1960, p. 44 + 1 page.

13493 Thiokol's "Man-Rated" Engine. Date on the XLR99-RM-1—the rocket engine designed for the X-15. ***John F. Judge.*** *Missiles and Rockets*, v. 7, no. 13, Sept. 26, 1960, p. 11-12.

13494* Generating Electricity . . . Directly From Raw Fuels. Concerns magnetohydrodynamics, fuel cells, and solar cells. *Power*, v. 104, Oct. 1960, p. 154-155.

13495 Proceedings of the Fourth National Turbine-Powered Air Transportation Meeting. Papers presented at the meeting held Nov. 17-18, 1959, in San Francisco. 72 pp. 1959. Institute of the Aeronautical Sciences, New York. (TL704.5 N21p Vis.)

13496* On the Possibility of Conversion of Adsorption Energy of a Cell Into Electric Work. (*In Polish.*) O możliwości zmiany energii adsorpcji w pracę elektryczną ogniwa. ***Witold Tomassi.*** *Przemysł Chemiczny*, v. 39, no. 6, June 1960, p. 357-359.

13497 Propulsion Requirements for Rendezvous in Orbit. Reviews several proposed guidance techniques with a view toward extracting information concerning the size, type, and characteristics of the propulsion systems that seem to be required for various phases of an orbital rendezvous operation. ***E. Levin.*** *Rand Corporation, Report* P-1908, Feb. 11, 1960, 29 pp. (T13 R15r Contin.)

13498 How Silicon Solar Cells Rate for Space Power. ***E. T. Raymond.*** *SAE Journal*, v. 68, Aug. 1960, p. 42-44.

13499 Energy Conversion Devices. Listing of devices that will be investigated in the next decade. ***Frank W. Anders.*** *SAE Journal*, v. 68, Aug. 1960, p. 45.

13500 Measuring the In-Flight Thrust Variable Nozzle Jets. Special flight tests used by Convair engineers. ***R. J. Patton.*** *Space/Aeronautics*, v. 34, no. 2, Aug. 1960, p. 89 + 5 pages.

13501 Exploding Wires. State-of-the-art survey emphasizes possible uses. ***Irwin Stambler.*** *Space/Aeronautics*, v. 34, no. 3, Sept. 1960, p. 48-51.

13502 Rocket Development Tackles Multi-Million-Pound Thrusts. Liquids. Solids. Designers of both liquid and solid propellant types claim thrusts of several million pounds are feasible. Liquids. ***H. C. Wieseneck and S. F. Iacobellis.*** Solids. ***H. W. Ritchey.*** *Space/Aeronautics, Research & Development Handbook*, v. 4, 1960-1961, p. C5-C9.

13503 Thermoelectricity. Includes proceedings of the Conference on Thermoelectricity held in Sept. 1958. Thermoelectric device design; some considerations of the problems of minimizing the weight of thermopile generators in space applications; chemical considerations in high-temperature thermoelectric power development; measurement of thermoelectric properties by using Peltier heat. ***Paul H. Egli, editor.*** 407 pp. 1960. John Wiley & Sons, New York. (QC621 Eg57t)

See also: **12959** (engines for supersonic air liners); **13399** (space propulsion systems); **13980** (welded fabrication of steel rocket-motor cases).

INFORMATION—PREPARATION AND DISSEMINATION

13504* Reading Machines Are at Work in Industry. One comparatively simple mechanical scanner with photocell sensing and computer logic is already working for several American

companies. Special typefaces (of quite pleasing appearance) are preferred, but it is claimed that any reasonable print or typing can be read with suitable settings. The system is self-checking like a computer and 40 times as fast as a typist. ***Jules Gronich.*** *Automation Progress*, v. 5, Aug. 1960, p. 261-264.

13505* The Relationship of Information to Data Processing. Discusses equating the cost of information to its value to management and suggests evaluation guides. Foresees a national storage depot of limitless information, available electronically. ***Edward A. Tomeski.*** *Data Processing*, v. 2, Aug. 1960, p. 21-24.

13506 Documentation of Building Science Literature. Proceedings of a program conducted as part of the 1959 Fall Conferences of the Building Research Institute, Division of Engineering and Industrial Research. 46 pp. 1960. National Academy of Sciences-National Research Council, Washington, D. C. (Z699.5.B8 N21.1d Over.)

13507 How to Cope With Information. Efficient information retrieval (I.R.) can prevent duplication of inventive effort in industry, which probably costs upwards of $1.25 billion, or 10% of all R. and D. investment. It seems clear that I.R. will be among the fastest-growing industries within a few years. ***Francis Bello.*** *Fortune*, v. 62, no. 3, Sept. 1960, p. 162 + 10 pages.

13508* Work Sampling in Library Administration. Work sampling, when correctly used, offers the library executive a powerful tool for the effective utilization of the personnel available to him. ***Scott Tabor Poage.*** *Library Quarterly*, v. 30, no. 3, July 1960, p. 213-218.

13509 The Materials Information Problem. The transmission of information is a three-phase process in which the originator, the user of information, and the media of communication between them all bear responsibilities that are steadily becoming more important in this, the Materials Age. ***M. W. Riley.*** *Materials in Design Engineering*, v. 52, Sept. 1960, p. 167-174.

13510 Mechanized Tutors Join the Teaching Profession. Mechanical, electronic and optical equipment is being developed that offers a speedup in training methods. A progress report and summary of the growing activity in this new field. ***Lewis H. Young.*** *Product Engineering*, v. 31, no. 41, Oct. 3, 1960, p. 48-51.

13511 Soviet Scientific and Technical Literature: Sources and Availability. A great deal has been done in the last few years to organize and correlate existing sources of information in the interest of more efficient coverage of Soviet materials. Contains a detailed bibliography of available Soviet technical literature. ***Rosemary Neiswender.*** *Rand Corporation, Report* P-1919, Feb. 23, 1960, 18 pp. (T13 R15r Contin.)

13512 Scientific Communication. Features several articles on the audience and shape and content of scientific information. *Research/Development*, v. 11, Sept. 1960, p. 5 + 39 pages.

See also: **13657** (Metal-Cutting Bibliography); **13701** (selected references on making high-temperature alloys by powder metallurgy).

INSTRUMENTATION

13513* Hydrogen Flame Ionization Detector. New developments in gas chromatography are the capillary or Golay columns and the ionization detectors of Lovelock and others. The Perkin-Elmer Corp. developed two types of flame ionization detectors. The principles of both detectors are the same: H and sample are mixed and the resulting stream is burned at a jet in a surrounding atmosphere of air. An electrode near the flame is electrically biased from the jet. The presence of detectable material in the sample results in flow of an ion current between the electrode and the flame jet. This ion current is measured. ***Leslie S. Ettre and H. Newell Claudy.*** *Chemistry in Canada*, v. 12, Sept. 1960, p. 34-36.

13514* Recent Developments in Nickel/Nickel-Chromium Thermocouples. The firm of Kanthal has developed a new alloy for the negative wire which by an addition of 2 to 3% Si substantially improved the resistance of Ni-NiCr-thermocouples against oxidation. Beyond this, the "Thermo-Kanthal"-alloy offers other advantages which contribute appreciably to improving the measuring properties of Ni-NiCr-thermocouples. The new thermocouple meets the U. S. standards. (*In German.*) Neue Entwicklungen und Erkenntnisse auf dem Gebiete der Thermo-Elemente des Types Nickel/Nickel-Chrom. ***B. Edwin.*** *Elektrowärme*, v. 18, July 1960, p. 222-225.

13515 Infrared Radiometry. Infrared radiometry is becoming a powerful tool for measuring minute temperature differences and temperatures at a distance. Here is a state-of-the-art survey of the optical materials used, the detectors available, and applications—industrial, meteorological, and military. ***Richard K. McDonald.*** *Instruments and Control Systems*, v. 33, Sept. 1960, p. 1527-1530.

13516* On a Study of New Contrast Improvement Technique for Replica Specimens. A study was made in a new contrast improvement technique, whereby a direct observation of the unevenness of the specimen surface was made practicable, and the technique was applied to the vacuum-evaporated replica film. The process is to mix epoxy resin of low viscosity and hardner of slow curing velocity, and the mixture is diluted in organic solvent. The solution is coated on the surface of the replica film and is cured by heating. ***Akira Fukami and Kôichi Adachi.*** *Journal of Electronmicroscopy*, v. 8, 1960, p. 42-46.

13517 Single Tube Sedimentation Apparatus for the Measurement of Particle Size Distribution. The equipment described is of the "liquid column with sediment extraction" type which enables dilute suspensions, 0.05% solids concentration by volume, to be used. Thus, the sedimenting conditions approximate to those required for unhindered settling of the particles. ***J. Kobak and D. J. Loveridge.*** *Journal of Scientific Instruments*, v. 37, Aug. 1960, p. 266-269.

13518 Multipoint Digital Temperature Recorder With Punched Tape Output. Describes 65-point potentiometric recorder which gives its output in binary form on punched tape directly suitable for use with a digital computer. The instrument operates intermittently, and provides reference times and parity and logical sum checks. ***T. S. Holden.*** *Journal of Scientific Instruments*, v. 37, Aug. 1960, p. 269-272.

13519 The Torsiometer—An Instrument for the Study of Gels Considered as Elastic Solids. The instrument records on a chart the progressive changes in torque required to give a fixed small value of deformation in an annular sample. The machine can be used for gel systems other than rubber and may therefore have applications in other fields. ***W. A. Southorn.*** *Journal of Scientific Instruments*, v. 37, Aug. 1960, p. 292-296.

13520 Novel Displacement Detector and Its Application in a Recording Thermobalance. A transducer was developed to detect changes in position of a balance beam. Its operation is based upon a differential capacitor. Variations in capacitance are made to produce directly a d-c voltage corresponding in sign to the sense of deflection of the balance beam. Describes the construction of the transducer. ***J. C. van der Breggen and H. J. Wouterlood.*** *Journal of Scientific Instruments*, v. 37, Aug. 1960, p. 297-300.

13521 Introducing the Flexagage . . . A Double-Deck Resistance Strain Gage. Describes an assembly that effectively distinguishes bending strain from axial strain, but with its pair of metal-foil elements mounted on the same side of the structure being tested. ***Felix Zandman.*** *Product Engineering*, v. 31, no. 42, Oct. 10, 1960, p. 55-57.

See also: **13079** (automatic coulometric titrator); **13351** (study of thixotropic fluids); **13429** (nuclear magnetic logging); **13454** (continuous velocity oil-well logger).

LUBRICATION AND FRICTION

13522 Theoretical and Experimental Analysis of Hydrostatic Thrust Bearings. Gives design equations for load-carrying capacity, stiffness, and flow for three different types of flow restriction—orifice, capillary, and constant flow. Experimental verification of the equations is shown. Each method of restriction imparts its own characteristics on the bearing performance. ***R. C. Elwell and B. Sternlicht.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 3, Sept. 1960, p. 505-512.

13523* Methods of Estimating the Operative Properties of Lubricating Oils With Radioactive Tracers. Radioactive tracers were used in connection with studies of admixtures to secure improved dispersion, detergency, and lubricating properties of oils for diesel engines. (*In Russian.*) Radioindikatornye metody issledovaniia ekspluatatsionnykh svoĭstv smazochnykh masel. ***Iu. S. Zaslavskiĭ and G. I. Shor.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 8-17, 1960". 18 pp. (QC770 C76pr)

13524* Radioisotopic Control of Wear on the Suspension Bearing of Large Turbogenerators. Silver containing AG-110 was electrodeposited on the Babbitt metal. A pulse integrator permitted the automatic recording of the wear kinetics. When a 50μ layer was used, the accuracy of determination of the wear control was between 1 and 2μ. When a 200μ coating was used, it was possible to measure a wider range of wear, but only with a 5μ accuracy. The first 94 megawatt turbogenerator at the Orlik State Power Plant will be equipped with the device described. (*In Russian.*) Kontrol' iznosa podvesnogo podshipnika krupnykh turbogeneratorov metodom radioizotopov. ***Z. Frynta, F. Kkhol', and V. Kopetskiĭ.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 8-17, 1960". 6 pp. (QC770 C76pr)

13525 The Effect of Additives on the Water-Induced Pitting of Ball Bearings. The most effective additive found was "iso-amyl alcohol" (commercial secondary amyl alcohol). An imidazoline derivative used commercially as a "de-watering" agent was also effective. Surface-active agents such as oleic acid and triethanolamine were satisfactory under conditions of high supersaturation with water. Water soluble anti-corrosive and detergent additives had no beneficial action. ***L. Grunberg and D. Scott.*** *Institute of Petroleum, Journal*, v. 46, Aug. 1960, p. 259-266.

13526 Abrasive Contamination of Precision Mechanical Devices. Used polarized light in a dark field to detect foreign particles measuring from 1-5 microns diameter. Explains probable nature of the failure mechanism and proposes some unorthodox cleaning procedures to minimize its effect on component life, reliability, and performance. ***L. McD Schetky.*** *Product Engineering*, v. 31, no. 33, Aug. 15, 1960, p. 51-54.

13527 Radioactive Metallic Tracers Used for Checking Oil Consumption. Sodium signal as a function of oil consumption; tagging with tritium; consumption and origin of material in exhaust and blowby. *Scientific Lubrication*, v. 12, July 1960, p. 26-28.

13528 The Role of Surface Shear Strains in the Adhesion of Metals. I. The effect of surface shear strains on the adhesion of Cu, Al, and Au surfaces is examined. It is shown that shear strains are necessary for adhesion to occur under most circumstances when unlubricated metals are in contact. ***O. L. Anderson.*** *Wear*, v. 3, no. 4, July-Aug. 1960, p. 253-273.

13529 Some Observations on the Frictional Behaviour of Boron Nitride and of Graphite. Describes experiments with layer-lattice crystals in pure chemical form. The specimens are cleaned by outgassing at high temperatures (1000-1200 C) *in vacuo* (5.10^{-4} microns) and purified gases and vapors are admitted. It is found that the friction of outgassed graphite is reduced from about $\mu = 0.45$ to about $\mu = 0.15$ by many different gases. ***G. W. Rowe.*** *Wear*, v. 3, no. 4, July-Aug. 1960, p. 274-285.

13530 A Study of the Wear of Steel Under Heavy Loads With Lubricants Containing Sulphur-Based Additives. A four-ball friction machine is described. It was employed to study the wear of hardened steel at considerable contact stresses in highly purified dearomatized bright stock and solutions of S and dibenzyldisulphide in the latter. Profilometric measurements were carried out, microhardnesses were determined, and a metallographic study was made in the friction zone. ***G. V. Vinogradov and O. E. Morozova.*** *Wear*, v. 3, no. 4, July-Aug. 1960, p. 297-308.

MECHANICAL ENGINEERING

13531 Synthesis of Epicyclic Gear Trains Using the Velocity Ratio Spectrum. A method of synthesizing compound epicyclic trains is developed using the concept of a velocity ratio spectrum. To facilitate the application of this concept, only one train in a compound epicyclic train is regarded as basic; all others are considered as merely serving the purpose of modifying the motion of the controlling element in the basic train. ***R. C. Brewer.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 173-178.

13532 The Twinworm Drive—A Self-Locking Worm-Gear Transmission of High Efficiency. A new type of worm transmission was developed which is self-locking, yet has a theoretical efficiency that can almost reach 100%. Describes the transmission and develops the theory upon which its operation is based. Design equations are derived for different operating conditions, and discusses a number of possible uses and applications. ***B. Popper and D. W. Pessen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 191-199.

13533 An Analysis of Factors Used for Strength Rating Helical Gears. Discusses the factors used to rate the strength of helical-gear teeth by means of the fundamental tooth-strength formula; combines different concepts of geometry factors, an improved evaluation of dynamic loads, rational allowable stresses, and risk or reliability considered as a statistical probability. ***E. J. Wellauer.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 205-212.

13534 Bending Strength of Gear Teeth by Cantilever-Plate Theory. A semiempirical solution is given for the finite cantilever plate under transverse loads at any location on its surface. The solution, which is based on the principle of superposition and a proposed moment-image method, showed good agreement with results from strain-gage investigations on cantilever plates simulating the gear tooth. The effects of the position of the line load and the variation of load intensity on the stress distribution at the root are discussed. ***E. J. Wellauer and A. Seireg.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 213-222.

13535 Rocket Motor Gear Tooth Analysis—Hertzian Contact Stresses and Times. Analyzes a rocket motor turbine-pump reduction gear system. The Hertzian contact stresses vary from approximately 100,000 to 200,000 psi. The times of contact vary from 3-8 microsec. Some observations regarding the correlation between contact times and gear failures are made. ***Ernest K. Gatcombe and Roy W. Prowell.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 223-230.

13536 Incidence and Deviation-Angle Correlations for Compressor Cascades. Presents an analysis for the variation of low-speed, minimum-loss, incidence angle and deviation angle for compressor-cascade blades. Discusses the aerodynamics governing behavior of these angles, and establishes the principal influencing parameters. ***Seymour Lieblein.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 3, Sept. 1960, p. 575-587.

13537 Steady-State Creep of a Thick-Walled Cylinder Under Combined Axial Load and Internal Pressure. Equations are developed for prediction of steady-state creep stresses and strain rates in a thick-walled tube under combined internal pressure and axial load. An analytical solution of the equations, in closed form, is not possible but numerical solutions to the

equations are tabulated for various values of the variables. ***Iain Finnie.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 82, no. 3, Sept. 1960, p. 689-694.

13538 Modeling of Large Transient Elastic and Plastic Deformations of Structures Subjected to Blast Loading. A model law is developed for scaling of response to blast loading of structures which undergo large elastic and plastic deformations. The geometrical scaling of response predicted by this law is verified by a series of experiments on small cantilever beams. ***W. E. Baker.*** *ASME, Transactions, Series E, Journal of Applied Mechanics,* v. 27, no. 3, Sept. 1960, p. 521-527.

13539 Effect of Small Hub-Radius Change on Bending Frequencies of a Rotating Beam. The first-order solution shows that a frequency parameter "γ" is a linear function of the hub-radius change and the constant of proportionality is readily obtainable from known parameters. The frequency "ω" itself can also be represented by a linear function of the hub-radius change. This confirms the results previously obtained by Boyce by repeated solutions of the differential equations for a particular beam. ***Hsu Lo, J. E. Goldberg, and J. L. Bogdanoff.*** *ASME, Transactions, Series E, Journal of Applied Mechanics,* v. 27, no. 3, Sept. 1960, p. 548-550.

13540 Random Excitation of a Loaded Nonlinear String. As a result of the additional stress induced by the stretching of the string, the mean squared deflection of every particle is reduced compared with that for the equivalent linear problem. ***T. K. Caughey.*** *ASME, Transactions, Series E, Journal of Applied Mechanics,* v. 27, no. 3, Sept. 1960, p. 575-578.

13541* Photoelastic Measurement of Surface Strain. II. Investigation of a Direct Method Using an Optically Sensitive Material Bonded to the Metal Component. Discusses test procedures and results, and bonded stress concentration and bonded lug specimens. ***J. R. Linge.*** *Aircraft Engineering,* v. 32, Sept. 1960, p. 261-270.

13542* High-Strength Deformed Steel Bars for Concrete Reinforcement. Results obtained from the testing to destruction of 42 T-beams reinforced with metallurgically produced high-strength steel deformed bars are presented. Both flexural and shearing failures occurred and results are compared with the ultimate strength design procedure given in the appendix of the 1956 ACI Building Code and certain other design procedures. ***Sidney A. Guralnick.*** *American Concrete Institute, Journal,* v. 32; *ACI Proceedings,* v. 57, no. 3, Sept. 1960, p. 241-282.

13543 Fluid Power Control. Discusses fluid power, properties of fluids, fundamentals of fluid flow, characteristics of positive-displacement pumps and motors, fluid-power transmission, on valve control, pressure-flow relationships for hydraulic valves, pressure-flow characteristics of pneumatic valves, valve configurations and constructions, steady-state operating forces, electromagnetic actuators, transient forces, valve instability, and other problems. ***John F. Blackburn, Gerhard Reethof, and J. Lowen Shearer, editors.*** 710 pp. 1960. John Wiley & Sons, New York. (TJ840 M38f)

13544* Electrohydraulic Servovalves in Industry. II. Application of Servovalves. Servosystem accuracy and performance; position, velocity, and force control systems. ***Harvard B. Kolm.*** *Hydraulics & Pneumatics,* v. 13, Aug. 1960, p. 72 + 3 pages.

13545* Press Safety Circuit Uses Standard Pneumatic Components. ***John F. Rosencrans.*** *Hydraulics & Pneumatics,* v. 13, Aug. 1960, p. 86-88.

13546* Pump Test Stand With a Future. High-temperature hydraulic pump test facility designed to operate with fluids at 700 F and permit 60 changes of pressure, flow rate and flow direction, in each 60-sec cycle; present requirements are for 600 F and four changes. ***Robert D. Cameron.*** *Hydraulics & Pneumatics,* v. 13, Aug. 1960, p. 91 + 4 pages.

13547* Ball Valves Permit Compact Flight Actuator Design. Instead of spools or slides, servocontrol actuators developed by a French aircraft designer use a ball valve arrangement to direct flow of hydraulic fluid. The balls themselves are positioned by an axial distributor actuated by an axial piston rod. Both are inside the cylinder barrel. The actuator is very small, can readily be accommodated in thin wing sections, and can be linked very simply to flight controls. ***W. M. Morrison.*** *Hydraulics & Pneumatics,* v. 13, Aug. 1960, p. 98 + 3 pages.

13548* An Electrical Analogue Solution for the Stresses Near a Crack or Hole in a Flat Plate. An electrical analogue for solving the biharmonic equation was used to determine the elastic stresses near a hole or crack in a flat rectangular plate subjected to uniaxial tension. Problems concerning both simply and multiply connected regions were solved by the method and, where a comparison between the experimental results and existing analytical solutions was possible, the agreement was good. ***S. C. Redshaw and K. R. Rushton.*** *Journal of the Mechanics and Physics of Solids,* v. 8, no. 3, Aug. 1960, p. 173-186.

13549 Turbopump Key to New X-15 Engine. Unit insures controllability and adequate fuel flow for Thiokol's XLR99 powerplant; turbine overhangs shaft. ***William Beller.*** *Missiles and Rockets,* v. 7, no. 7, Aug. 15, 1960, p. 33-34.

13550 Pressure Vessel and Piping Design. Collected Papers 1927-1959. Discusses openings, bolted-flanged joints, heads, shells, piping, materials and fabrication, thermal stress and fatigue, loads and supports, effects of external pressure, and other problems. 710 pp. 1960. The American Society of Mechanical Engineers, New York. (TS283 Am35p Over.)

13551 Angular Errors in Gears. Gearing errors; causes of angular error; effect of center-distance variation; tooth-thickness variation; errors caused by pitch deviations; involute-profile error; pitch-diameter eccentricity; lead-angle error; errors caused by wobble; effect of misalignment and tilt; summary of equations; maximum and probable totals of angular errors; statistical analysis of angular error. ***T. C. Nielsen.*** *Product Engineering,* v. 31, no. 33, Aug. 15, 1960, p. 56-61.

13552 Progress in Solid Mechanics. Discusses viscoelastic waves, matrices of transmission in beam problems, dynamic expansion of spherical cavities in metals, general theorems for elastic-plastic solids, dispersion relations for elastic waves in bars, thermoelasticity, the dynamical theory, continuous distributions of dislocations, asymmetric problems of the theory of elasticity for a semi-infinite solid and a thick plate. ***I. N. Sneddon and R. Hill, editors.*** v. I. 448 pp. 1960. Interscience Publishers, New York. (QC125 P94 Vis.)

13553 Stresses in Shells. General properties of stress systems in shells; direct stresses in shells of revolution, cylindrical shells, and shells of arbitrary shape; bending of circular cylindrical shells; bending stresses in shells of revolution; buckling of shells; forces and deformations in circular rings. ***Wilhelm Flügge.*** 499 pp. 1960. Springer-Verlag, Berlin. (TA492.S55 F67s)

METALLURGY

13554 Preparation and Properties of High Purity Scandium Metal. Preparation of pure Sc metal was accomplished by Ca reduction of the fluoride by two methods; a low-temperature alloy process and direct reduction with subsequent distillation of the product. Physical properties are tabulated and discussed. ***F. H. Spedding, A. H. Daane, G. Wakefield, and D. H. Dennison.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 4, Aug. 1960, p. 608-611.

13555* Development of Wrought Cobalt-Tungsten-Base Alloys. The high-temperature properties of Co-W alloys were seen to compare favorably with those of HS 25. It appears quite likely that improvements could be obtained by suitably modifying their composition or heat treatment. In their present early stage of development, Co-W-base alloys appear to have rupture properties at 982 C (1500 F) superior to those of commercial alloy HS 25. An important advantage of the Co-W alloys is their ability to be hot worked. The potentialities of Co-W-base alloys for tool applications must be investigated more thoroughly. ***E. F. Adkins, D. N. Williams, and R. I. Jaffee.*** *Cobalt,* no. 8, Sept. 1960, p. 16-29.

13556 The Navy's Refractory Metals Program. Special emphasis is placed upon development of Mo alloys; one phase of the program concentrates upon production of Mo alloy sheet by powder-metallurgy techniques; another phase is readying an air-tight room for processing refractory metals under genuine hot-working conditions; effort appears to be a comprehensive one. ***T. F. Kearns and J. Maltz.*** *Journal of Metals*, v. 12, Aug. 1960, p. 611-614.

13557 Magnesium Alloys for Nuclear Engineering. Production of alloys, fabrication, inspection and possible developments of Mg alloys for the nuclear power industry are discussed. ***C. J. Smith.*** *Metal Industry*, v. 97, Aug. 5, 1960, p. 107-110.

13558 Aluminum Gains as Motor Case Material. Cases were fabricated from high-strength 7178-T6 aluminum alloy by combined forging, extruding, sizing and machining processes. Alcoa is conducting large-scale research program to increase size-limits by welding. ***John F. Judge.*** *Missiles and Rockets*, v. 7, no. 9, Aug. 29, 1960, p. 32 + 1 page.

13559 Tailoring Advanced Alloys for High Performance Flight Environments. The emphasis in materials has shifted from the deliberate and conservative approach to that of tailoring a wide range of relatively new materials to specific jobs. This approach calls for comprehensive testing of new materials under specific conditions, as was done in the study of short-time high temperature properties reviewed. ***Robert E. Mihalco.*** *Space/Aeronautics, Research & Development Handbook*, v. 4, 1960-1961, p. H6-H8.

13560 Columbium Alloys. Graphic and tabular data for physical and mechanical properties of Cb and columbium-base alloys. ***E. S. Bartlett and J. A. Houck.*** *Space/Aeronautics, Research & Development Handbook*, v. 4, 1960-1961, p. H12-H13.

13561 Preparation and Evaluation of Aluminum-35 w/o Uranium Alloys Containing up to 3 w/o Tin or Zirconium. The effects of ternary additions of up to 3 w/o Sn or Zr to the Al 35 w/o U extrusion alloy were evaluated on the basis of casting characteristics, UAl_3 retention, extrusion behavior, mechanical properties, and corrosion resistance. Both additions increased the fluidity of the alloy, and both promoted retention of UAl_3. The retention of UAl_3 decreased the extrusion pressure needed for fabrication and caused a corresponding decrease in tensile and creep-rupture properties. Reductions in strength were most noticeable at elevated temperatures. ***Norman E. Daniel, Ellis L. Foster, Jr., and Ronald F. Dickerson.*** *U. S. Atomic Energy Commission, BMI-1454*, July 29, 1960, 28 pp. (UF767 U3b Contin.)

METALS—CORROSION

13562 The Kinetics of Wustite Scale Formation on Iron. The kinetics of scale formation on Fe in CO_2 atmospheres were determined in the temperature range 600 - 1000 C by a thermogravimetric technique. The scale constituents were identified by means of X-ray and microscopic examinations. Linear scaling was determined by the rate of incorporation of chemisorbed O into the wustite lattice at temperatures lower than 910 C. ***W. W. Smeltzer.*** *Acta Metallurgica*, v. 8, June 1960, p. 377-383.

13563 The Oxidation of Iron in Carbon Dioxide-Carbon Monoxide Atmospheres. The linear formation rates of wustite films were determined over the temperature range 590-1030 C using a vacuum microbalance technique. These rates are dependent directly on the partial pressure of carbon dioxide. Activation energies for film and scale formation in carbon dioxide and O atmospheres are equivalent to either the dissociation energies of carbon dioxide and O, or the activation energy for the diffusion of cation vacancies in wustite. ***W. W. Smeltzer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 4, Aug. 1960, p. 674-681.

13564 Oxidation Behavior and Protective Coatings for Columbium and Columbium-Base Alloys. Summarizes and discusses the available information on the above. Four phases occur in the Cb-O system: Cb-O solid solution, CbO, CbO_2, and Cb_2O_5. At low temperatures and O pressures, the Cb-O reaction proceeds at a very low linear rate and no scale is formed. At slightly higher temperatures and pressures, an unidentified adherent scale forms and the reaction proceeds parabolically. Parabolic behavior is followed in air to about 400 C, accompanied by formation of a visible tarnish film. ***W. D. Klopp.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 123, Jan. 15, 1960, 98 pp. (TN799.T5 B32.7t Vis.)

13565 The High-Temperature Aqueous Corrosion Resistance of the Uranium-5% Zirconium-1½% Niobium Alloy. This alloy shows good corrosion resistance, as gamma quenched, in water to about 315 C. Optimum heat treatment results in a rate of about 6 mg/cm²/day at 290 C. Moderate aging, e.g., 400 C for 2 hr, results in reduced corrosion rates in the initial stages of corrosion. ***J. E. Draley, S. Greenberg, and W. E. Ruther.*** *Electrochemical Society, Journal*, v. 107, Sept. 1960, p. 732-740.

13566 Inhibition of Acid Attack on Steel by Heavy Metal Ions. Ions of Pb, Sn, and Cd were shown to inhibit the dissolution of steel in acid solutions in the absence of metal plating. The order of effectiveness of inhibition of ions of Pb, Sn, and Cd was shown to coincide with the order of solubility of the respective metal sulfides. ***Joseph A. Shropshire.*** *Electrochemical Society, Journal*, v. 107, Sept. 1960, p. 740-744.

13567 Cupro-Nickel, Admiralty Tubes Resist Corrosion Better. Pilot plant studies, using Na-zeolite softened water, indicate excellent corrosion resistance over wide temperature and velocity ranges for 90/10 cupro-nickel and admiralty tubing. ***Malvern F. Obrecht and Laurence L. Quill.*** *Heating, Piping & Air Conditioning*, v. 32, Sept. 1960, p. 125-133.

13568 Metals for Sea Water Service. Discusses factors in sea-water corrosion of steel, cast iron and wrought iron, Al and its alloys, copper-base alloys, cupro nickels, monel, Hastelloy C, and Ti. ***Frederick W. Fink.*** *Industrial and Engineering Chemistry*, v. 52, Sept. 1960, p. 70A + 2 pages.

13569 Oxidation Mechanisms of Niobium, Tantalum, Molybdenum and Tungsten. From published observations on the behavior during oxidation of the four metals considered and from the properties of the oxides formed, the probable mechanism of oxidation is discussed. The known effects of alloying elements are dealt with in the light of this mechanism, and some consideration is given to other possibilities of improving oxidation resistance by simple alloying. ***O. Kubaschewski and B. E. Hopkins.*** *Journal of the Less-Common Metals*, v. 2, nos. 2-4, Apr.-Aug. 1960, p. 172-180.

13570 The Oxidation of Niobium-Titanium and Niobium-Molybdenum Alloys. The oxidation rates of several Nb-Ti and Nb-Mo alloys were measured over a considerable range of temperature and the results may be understood in terms of the chemical and physical properties of the scales. ***B. B. Argent and B. Phelps.*** *Journal of the Less-Common Metals*, v. 2, nos. 2-4, Apr.-Aug. 1960, p. 181-190.

13571 The Development of Oxidation-Resistant Niobium Alloys. Various mechanisms, whereby the addition of an alloying element to Nb may influence the oxidation resistance, are examined in the light of previous experimental work; it is concluded that the effects observed are probably due to the combination of a number of factors. An account is given of systematic investigations into the oxidation resistance of an extensive range of ternary and more complex Nb alloys, containing from 9 to 25 at.% Ti, which have succeeded in identifying ductile and refractory alloys showing oxidation rates at 1,100 C of about 1% of that of pure Nb metal. ***R. Smith.*** *Journal of the Less-Common Metals*, v. 2, nos. 2-4, Apr.-Aug. 1960, p. 191-206.

13572* Propose New Theory for Rusting of Iron. Recent findings indicate H ions or protons in water vapor as true culprits of corrosion; experiments testing the new theory eliminated conditions for normal electrochemical reactions. *Plant*, v. 22, Sept. 1960, p. 54.

13573 Characteristics of Anodic and Corrosion Films on Zirconium. Zirconium anodizes similarly to W in respect to the change of interference colors with applied voltage. By measuring the interference color and capacitative thicknesses on Zr (Grades I and III) and a 2.5 w/o tin alloy, the film was found to grow less rapidly in terms of capacitance than in terms of interference colors. The effect was most pronounced on Grade III Zr and least pronounced on the tin alloy. The reduction in capacitative thickness was especially noticeable when white oxide appeared. Tin is believed to act in two distinct ways: to counteract the tendency of the oixde to form cracks, and to produce vacancies which promote ionic diffusion. ***R. D. Misch.*** *U. S. Atomic Energy Commission, ANL-6149,* May 1960, 25 pp. (UF767 Un3.1an Contin.)

13574 Creep and Corrosion Properties of Zircaloy-2 in Steam at 750 F. Test equipment to determine the creep properties of Zircaloy-2 in a 750 F 500-psi steam atmosphere was designed and constructed. Duplicate tests were performed at stresses to produce failure in approximately 1, 10, 100, and 1000 hr. A comparison between these data and data obtained in vacuum-test equipment shows that a corrosive test atmosphere does not alter ductility or failure times appreciably. ***Edward J. Jablonowski and Frederic R. Shober.*** *U. S. Atomic Energy Commission, BMI-1457,* Aug. 1, 1960, 20 pp. (UF767 U3b Contin.)

13575* Effects of Lead Additions on the Corrosion Resistance of Electrolytic Zinc. With Pb additions from 0.08 to 1.35 wt %, Zn in acid and alkaline media, exhibits higher resistance to corrosion. This resistance depends especially on the effects on the cathodic process of H production; thus in an acid medium, Pb additions have a high inhibiting effect. The Zn-Pb constitution diagram with a corrosion curve of the alloy reveals the highest corrosion resistance in the eutectic composition. (*In Russian.*) O vliianii primeseĭ svintsa na korrozionnuiu ustoĭchivost' elektrolitnogo tsinka. ***I. E. Titova and T. Khamaganova.*** *Zhurnal Prikladnoĭ Khimii,* v. 33, no. 7, July 1960, p. 1591-1594.

See also: **13525** (pitting of ball bearings).

METALS—EXTRACTION AND REFINING

13576 The Development of Modern Copper Smelting. Review article, suggestions for future exploitation. ***Charles R. Kuzell.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 4, Aug. 1960, p. 578-584.

13577 New Tough Pitch Continuous Copper Melting and Casting Unit at Asarco's Perth Amboy Plant. Design features and operating methods of Asarco's new unit for the continuous melting and casting of tough pitch Cu at Perth Amboy. Presents preliminary studies made for determining economic feasibility and design details. ***G. D. Storm and J. R. Stone.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 4, Aug. 1960, p. 584-590.

13578 A Summary of Comparative Properties of Air-Melted and Vacuum-Melted Steels and Superalloys. Presents under a single cover all the information obtained by DMIC on comparative properties of air-melted and vacuum-melted steels and superalloys. No attempt is made to compare different alloys. The report is confined to the comparison of mechanical properties. Data on inclusion content, gas analysis, and so forth are included only in conjunction with mechanical-property data. ***D. C. Ludwigson and F. R. Morral.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 128, Mar. 28, 1960, 144 pp. (TN799.T5 B32.7t Vis.)

13579 Mixing of Metal and Slag in Open-Hearth Furnaces. Investigated the mixing action of open-hearth steel baths under steady melting conditions by the use of P^{32}. Determined the time required for uniform distribution of minute amounts of an addition of P^{32} during the ore boil throughout the metal and slag. ***A. I. Osipov, L. A. Shvartsman, M. T. Bul'skii, and A. G. Alimov.*** *Henry Brutcher Translation No.* 3673, 15 pp. + 9 figures. (From *Stal'*, v. 15, no. 8, 1955, p. 709-713.) Henry Brutcher, Altadena, Calif.

13580 Temperature Control in the Blast Furnace Hearth Through the Physical and Chemical Properties of the Slag, in Pig Iron Production. The temperature at which the primary slag becomes fully liquid is a major factor in the control of the temperature in the hearth zone. The presence of magnesia is an aid in the production of low viscosity liquid slag, providing that the presence of S in the pig iron is not troublesome. ***W. W. Michailow.*** *Henry Brutcher Translation No.* 3949, 9 pp. + 5 figures. (From *Die Neue Nütte*, v. 1, no. 4, 1956, p. 235-237.) Henry Brutcher, Altadena, Calif.

13581 Agitation of Steel Bath and Equalization of Its Temperature by Electromagnetic Mixing. To secure ordered movement of metal on the surface towards the working door, the penetration depth should be not more than half the maximum bath depth. Electromagnetic bath mixing sharply reduces temperature inequalities. ***N. V. Okorov and L. A. Mal'tsev.*** *Henry Brutcher Translation No.* 4674, 14 pp. + 6 figures. (From *'Proizvodstvo i Obrabotka Stali i Splavov'* (Production and Further Processing of Steel and Alloys). Collection of Papers No. 38 from Moscow Steel Institute; published by Metallurgizdat, Moscow, 1958, p. 185-195.) Henry Brutcher, Altadena, Calif.

13582 Experience With Direct Recording Spectrographs in a Steelworks Laboratory. Besides preliminary and finished control tests from the LD steel furnaces, tests from open-hearth and electric furnaces were examined spectrometrically. Discusses effects of third elements, preliminary treatment of tests and samples, and melting practice on the accuracy of the determinations. ***Th. -K. Willmer and W. Liedtke.*** *Henry Brutcher Translation No.* 4793, 8 pp. (From *Archiv Eisenhüttenwesen*, v. 30, no. 12, 1959, p. 713-714.) Henry Brutcher, Altadena, Calif.

13583 Metallurgy of Oxygen Top Blowing Process. Discusses kinetics of reactions of gaseous O with liquid pig iron and steel, refining processes for C, Si, Mn, P, and S with different furnace practices, effect of various cooling practices on temperature conditions. ***E. Plöckinger and M. Wahlster.*** *Henry Brutcher Translation No.* 4828, 33 pp. + 15 figures. (From *Stahl und Eisen*, v. 80, no. 7, 1960, p. 407-416; *Tech. Mitt. Krupp*, v. 17, no. 6, 1959, p. 295-305.) Henry Brutcher, Altadena, Calif.

13584 Theory and Practice of Deoxidation of Steel. Discusses fundamentals of deoxidation of steel with Al, production of 1.0% C, 1.5% Cr bearing steel of maximum cleanness by deoxidation practice. ***N. N. Dobrokhotov.*** *Henry Brutcher Translation No.* 4855, 7 pp. + 1 figure. (From *Izvest. VUZ-Chern. Met.*, no. 10, Oct. 1959, p. 23-28.) Henry Brutcher, Altadena, Calif.

13585 Vacuum Treatment of Liquid Ferrochromium in Ladle. Describes the production of low carbon and carbon-free ferrochromes by blowing carbon dioxide through the heats in a ladle. Discusses gas contents of ferrochromiums and vacuum treatment of metallic manganese. ***N. Ya. Neimark.*** *Henry Brutcher Translation No.* 4868, 6 pp. (From a Collection of Papers Entitled *"Primenenie Vakuuma v Metallurgii"* (Use of Vacuum in Metallurgy), USSR Academy of Sciences Press, Moscow, 1958, p. 129-131.) Henry Brutcher, Altadena, Calif.

13586 Extractive and Physical Metallurgy of Plutonium and Its Alloys. Based on a Symposium of the Nuclear Metallurgy Committee, American Institute of Mining, Metallurgical, and Petroleum Engineers held in San Francisco, Feb. 16-17, 1959. Discusses alternative routes for the conversion of Pu salts to metal, Ca reduction of Pu halides to metal, preparation of metallic plutonium, distribution of Pu and selected impurity elements between nitrate solutions and tri-*n*-butyl phosphate, the preparation of Pu halides for fused salt studies, removal of fission product elements from Pu by liquation, some principles of the alloying behavior of Pu, and Pu, and Pu-Ce phase diagram, Pu-Zn phase diagram, metallography of α Pu, the etching of Pu and other problems. ***W. D. Wilkinson, editor.*** 314 pp. 1960. Interscience Publishers, New York. (TN693.p9 Am35.5e)

13587* Experimentation in Applying High Gas Pressure in Blast Furnace Operation. Production of pig iron was 5% higher due to the introduction of higher pressure in the blast

furnace, and coke waste and coke requirements were somewhat decreased. Improvement of the total efficiency of the high-pressure conditions depends on the further increase of the gas pressure, on improvement of the durability and tightness of the bell-shaped closing devices, and on improvement of the system equalizing the pressure between the bell-shaped devices. (*In Czech.*) Zhušenosti s provozem se zvýšeným tlakem plynu u vysokých pecí NHKG. ***František Marek.*** *Hutník (Czech,)* v. 10, no. 8, Aug. 1960, p. 297-302.

13588 The Hot Blast Cupola. Installation of a premelting plant at steelworks has proved itself by flexible, economic operation. ***Friedrich Lüth.*** *Iron & Steel,* v. 33, no. 9, Aug. 1960, p. 418-422.

13589 Flow Patterns in Three-Dimensional Shapes. A Background for Furnace Design. With solids of revolution or shapes produced by sideways translation the basic flow pattern can be predicted from the two-dimensional studies. Flow in the cube may be considered as the general prototype for all furnaces, while that in the sphere and hemisphere, illustrates the kind of flow which occurs when gas holders are filled and ignition hoods used on sinter strands. ***N. P. Bacon, J. H. Chesters, and I. M. D. Halliday.*** *Iron and Steel Institute, Journal,* v. 195, pt. 3, July 1960, p. 286-292.

13590* The Use of Raw Forsterite Brick on Low Volume Furnaces. The following recommendations were made, among others, for a more effective use of this type of brick: Build the forsterite part according to the Cowper system at 75 to 80% the height generally admitted. Under the forsterite, make a checker brickwork of high-grade chamotte brick according to the Siemens system (with the same size of honeycomb). At the top of the brickwork maintain the heating temperature not lower than 1350-1400 C. (*In Russian.*) Primenenie bezobzhigovogo forsteritovogo kirpicha na pechakh maloi emkosti. ***G. I. Antonov, S. F. Khalemskii, E. L. Kal'noi, and V. F. Poliakov.*** *Metallurg,* v. 5, no. 7, July 1960, p. 17-20.

See also: **13011** (basic refractories for open-hearth furnace checkers); **13392** (combustion of pulverized fuel); **13817** (iron-ore reduction by low-shaft furnace).

METALS—FINISHING, POLISHING, AND CLEANING

13591* Ultrasonics Boost Metal Finishing. Ultrasonic methods are now being applied commercially for surface cleaning and machining and are becoming significant for deburring the surfaces of precision components. ***Peter W. Sherwood.*** *Carbide Engineering,* v. 12, Sept. 1960, p. 18 + 2 pages.

13592* Causes of Surface Defects in Brass Tapes. Causes of the defects detrimental to the quality of the brass tapes produced were determined by a long-time investigation of a large number of hot-rolled, individually cast, brass plates. Effects of the rolling temperature, chemical composition, macrostructure casts, surface quality of rollers, heating method, and annealing and pickling on the surface quality were studied. (*In Czech.*) *Příčiny povrchové plenivosti mosazných pásů.* ***Lumir Holub.*** *Hutník (Czech),* v. 10, no. 7, July 1960, p. 272-273.

13593* Integrated Metal Finishing. The Du Pont Triclene system of pretreatment and painting using trichloroethylene-based media throughout is described with reference to the economies that can result from its use. *Product Finishing,* v. 13, Sept. 1960, p. 63-67.

13594* Progress in Ultrasonics for Metal Finishing. Reviews recent progress in the U.S. on the development of ultrasonics, both in regard to their ease of generation and the finishing systems to which they may be applied. ***Peter Sherwood.*** *Product Finishing,* v. 13, Sept. 1960, p. 76-78.

METALS—FOUNDRY PRACTICE

13595 Two-Layer Shell Molds for Iron Castings. Describes development work on cheaper and stronger two-layer shell molds, the thin inner layer consisting of a thermo-setting sand-resin mixture, the thicker outer layer of a chemically setting sand waterglass mixture. ***A. A. Smirnov and I. V. Bobysheva.*** *Henry Brutcher Translation No.* 4815, 12 pp. + 4 figures. (From *Liteinoe Proizvodstvo,* v. 10, no. 9, 1959, p. 14-15.) Henry Brutcher, Altadena, Calif.

13596 Some Factors Affecting the Hot Tearing of Steel Castings. I. Contraction and Mechanical Strength of Steel During Solidification. Cites results of investigation contraction of carbon steel castings, of the relationship between the contraction and Ni, O, and hydrogen content in steel. ***A. M. Lyass and Chou Yao-huo.*** *Henry Brutcher Translation No.* 4864, 17 pp. + 11 figures. (From *Liteinoe Proizvodstvo,* no. 3, Mar. 1958, p. 20-24.) Henry Brutcher, Altadena, Calif.

13597 Special Features of the Inoculation of Cupola Iron With Cerium [Misch Metal]. Discusses experiments on the effect of Ce additions to liquid cast iron, size and shape of graphite in cast iron with and without misch metal, effect of inoculation on S content of cast iron. ***P. I. Talanov and N. I. Astafurova.*** *Henry Brutcher Translation No.* 4874, 4 pp. + figures. (From *Liteinoe Proizvodstvo, no.* 4, Apr. 1960, p. 42-44.) Henry Brutcher, Altadena, Calif.

13598* Iron Moulds Best for Centrifuge Casting. Considers best technique is to use Fe or steel molds and to cast directly, except for mold dressing, against the mold walls. Improved grain structure and mechanical properties are claimed. ***J. W. Cherrett.*** *Canadian Metalworking,* v. 23, Aug. 1960, p. 49-51.

13599* Surface Treatment of Die-Casting in "Zama" Alloys. A short study of the optimum conditions of the surface layer of the die cast before receiving a protective coating is conducted. The procedure followed in die-casting in order to obtain a compact and nonporous skin, and the cycle of deposition of the protective coating, Cu or bronze, brass, Ni and Cr, are explained with references to the recent studies of Brown. (*In Italian.*) Trattamento superficiale dei getti pressofusi in lega "zama". ***Gianluigi Galli.*** *Fonderia,* v. 9, July 1960, p. 319-323.

13600* Effects of the Moisture Content of the Air on the Crushing Strength of Cores Made by Applying the CO_2 Cold-Setting Process. Cores, which by direct contact with water absorb high quantities of this liquid for a short time, thus losing some of their strength, were exposed to air with up to 90% moisture (20 C). A drying process was observed which, depending on the chemical composition and the hardening of the water glass, increases or decreases the strength. (*In German.*) Einfluss der Luftfeuchtigkeit und der Lagerdauer auf das Druckfestigkeitsverhalten von nach dem Kohlensäure-Erstarrungsverfahren hergestellten Kernen. ***Inge Bindernagel.*** *Giesserei,* v. 47, no. 16, Aug. 11, 1960, p. 423-427.

13601 The Influence of Pore Size on Some Properties of Foundry Sand. Mathematics for predicting properties such as thermal conductivity, permeability, resistance to metal penetration on the basis of pore size. ***J. H. Gittus.*** *Iron & Steel,* v. 33, no. 9, Aug. 1960, p. 429-433.

13602 Continuous Casting at Terni. Attempts to relate to interested iron and steel technologists the sum of experience acquired during a rather long starting-up period and during operations subject to many vicissitudes. ***M. Signora and R. Cardano.*** *Iron and Steel Institute, Journal,* v. 195, pt. 3, July 1960, p. 253-260.

13603 Degassing of Steel by Vacuum Casting for the Production of Castings and Forgings. Vacuum degassing has been practiced at the Società Italiana Acciaierie Cornigliano (SIAC) since the end of 1958. Describes the plant and gives a detailed account of vacuum ingot-mold degassing and ladle-to-ladle degassing, together with the results achieved and conclusions reached after the first year of operation. ***V. Scalise, A. De Negri, and V. Piccardi.*** *Iron and Steel Institute, Journal,* v. 195, pt. 3, July 1960, p. 260-266.

13604* Mechanism of the Effects of Chromium on the Casting of a Rimmed Steel Ingot. From 0.5 to 0.43 Cr in rimmed steel does not increase the carbide phase and the Cr carbides in the metal to any extent. When there is an abnormal Mn content (0.32 - 0.35%) in rimmed steel, up to 0.25% Cr has no practical effect on the level of O content, but the boiling intensity in the molds becomes very low. During the formation of the ingot of Cr-containing rimmed steel, there is a considerable Cr oxidation. (*In Russian.*) O mekhanizme vliianiia khroma na formirovanie slitka kipiashcheĭ stali. ***V. S. Konovalov and V. I. Lapitskiĭ.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia,* 1960, no. 6, p. 41-46.

13605* Premium Quality Magnesium Castings for Missile Applications. Summary of techniques employed in the M.I.T. foundry laboratory for producing prototype Mg castings for missile applications. Deals primarily with AZ91C alloy. Presents research on mold coatings to improve fluidity. ***M. C. Flemings, E. J. Poirier and H. F. Taylor.*** *Modern Castings,* v. 38, Sept. 1960, p. 91-98.

13606* Nozzles for Uniform Water Spraying in Continuous Casting Machines. The use of the light and relatively simple YuUMZ-11 nozzle for secondary cooling of the continuously cast billet makes it possible to improve metal quality in view of the more uniform water spraying that is attained as compared with nozzles of other designs. ***M. Ya. Brovman, E. V. Surin, and V. S. Litvinov.*** *Stal' in English,* 1960, no. 5, May, p. 334-337.

METALS—HEAT TREATMENT

13607 Effect of Heat Treatment in the Ferrite-Austenite Region on Notch Toughness of Low-Carbon Steels. Notch toughness of 0.10% C steels, rimmed or killed, is improved by holding the steel at a temperature just above the Ae_1, followed by air cooling. The improvement can be gained without apparent change in gross microstructure or hardness. Limits of the process were determined and some possible reasons for the observed effects are discussed. Results appear to indicate that the current theories of transition temperature are inadequate. ***W. C. Leslie, R. L. Rickett, and W. D. Lafferty.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 4, Aug. 1960, p. 699-709.

13608 Annealing of [Butt] Welded Rods of High-Speed Steel. The new annealing cycle, based on the use of welding heat, does not reduce the mechanical properties of welds in high-speed steels, but decreases bark thickness and shortens the annealing time by about 40%. ***B. L. Aleksandrov and M. I. Gol'dvasser.*** *Henry Brutcher Translation No.* 4325, 4 pp. + 2 figures. (From *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1958, p. 59-60.) Henry Brutcher, Altadena, Calif.

13609 Open Coil Process Shows Way to Gas Alloying. Process utilizes special-atmosphere gases to control steel interstitials during the annealing cycle; comprehensive article, includes numerous charts and diagrams. ***J. Arnold.*** *Iron and Steel Engineer,* v. 37, Aug. 1960, p. 91-111.

13610* Effects of Thermal Treatment on the Cracking Due to Corrosion in Chromium-Nickel-Molybdenum Steels. The structural condition has an effect on this type of cracking. In order to eliminate it from potential loops made of steels OKh23N28MZDZT and Kh23N28MZDZT, used in sulfuric acid solutions, annealing at 950 C during 30 minutes, one and two hours is recommended. Quite reliable mechanical qualities are obtained in the steel thus treated. (*In Russian.*) Vliianie termoobrabotki na korrozionnoe rastreskivanie khromonikel'molibdenovykh staleĭ. ***Iu. S. Sidorkina.*** *Khimicheskoe Mashinostroenie,* 1960, no. 4, July-Aug., p. 17-20.

13611* Rotational Feed Hardening Opens New Fields for Flame Hardening. Hardening with rotating feed enables greater depth of hardening to be obtained than is possible with processes using ordinary feed movements. If much greater hardness is required for reasons of strength or wear, the new process is preferred. (*In German.*) Das Umlaufhärten erschliesst dem Brennhärten neue Anwendungsgebiete. ***H. W. Gröne-gress.*** *Schweissen und Schneiden,* v. 12, May 1960, p. 244-247.

13612* The Importance of the Annealing Process in Non-Ferrous Tube Production. Scovill Mfg. Co. and Surface Combustion Corp. co-operated in designing new heat-treatment units for improving the quality of brass and cupro-nickel tubing. Key items in the process are controlled atmosphere, continuous roller-hearth annealing furnaces. *Sheet Metal Industries,* v. 37, Aug. 1960, p. 601 + 4 pages.

See also: **13732** (annealing of W).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

13613 Cycle-Dependent Stress Relaxation of A-286 Alloy. Tubular fatigue specimens of A-286 alloy were axially tested under conditions of controlled strain, and the cycle-dependent relaxation of mean stress measured. It was found that, in the case of A-286 alloy, most of the relaxation occurred early in the fatigue life. ***A. S. Ross and JoDean Morrow.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 82, no. 3, Sept. 1960, p. 654-660.

13614 Low-Cycle Fatigue of Two Nickel-Base Alloys by Thermal-Stress Cycling. Cast DCM and cast Udimet 500, two nickel-base alloys, were tested in a thermal-stress-cycling device of the Coffin type. The strains induced by the thermal stresses were analyzed in several ways in an attempt to relate the plastic strains to cyclic life. ***F. J. Mehringer and R. P. Felgar.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 82, no. 3, Sept. 1960, p. 661-670.

13615 The Stability of Metals Under Cyclic Plastic Strain. It was observed that under certain conditions, materials subjected to cyclic plastic strain showed little stability to simultaneously imposed steady stresses. Describes and interprets some experiments undertaken to learn more about this behavior of real materials. ***L. F. Coffin, Jr.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 82, no. 3, Sept. 1960, p. 671-682.

13616* Study of the Fatigue Behavior of High Quality Carbon Steels Produced in the Rumanian Popular Republic. I. Standardized Steels. Fatigue limits during rotating bending tests according to a symmetric cycle were determined for carbon steels OLC 35, OLC 45, and OLC 60. A statistical study was made of the results obtained on specimens prepared from 21 different casts from each type in order to determine their probable fracture limit. (*In Rumanian.*) Studiul comportării la oboseală a oţelurilor carbon de calitate, fabricate in R.P.R. I. Otelurile in stare normalizată. ***St. Nădăşan, Al. Bernath, and E. Ioviţiu.*** *Academia Republicii Populare Romine. Baza de Cercetări Ştiinţifice Timisoara. Studii si Cercetări Ştiinţifice. Seria Ştiinţe Technice,* v. 7, nos. 1-2, Jan.-June 1960, p. 7-26.

13617 Dispersed Particle Hardening of Aluminum-Copper Alloy Single Crystals. Single crystals were grown in Al-Cu alloys containing 3-5% Cu and were strained in tension after heat treatments designed to develop $CuAl_2$ particles of varying sizes and distributions. Values of the critical resolved shear stress were found to be inversely proportional to the mean spacing between particles. Critical resolved shear stress was observed, deformation took place mostly by multiple slip, the external characteristics of the deformation being similar to those of polycrystalline material. ***D. Dew-Hughes and W. D. Robertson.*** *Acta Metallurgica,* v. 8, Mar. 1960, p. 147-155.

13618 The Mechanism of Hardening in Aged Aluminum-Copper Alloys. Single crystals grown in aluminum-copper alloys containing 1-5% Cu and tested in tension after an air-quench from the solution-treating temperatures. The aging behavior of crystals containing 4% Cu was studied by X-rays and by hardness tests. Crystals in all stages of aging obeyed the critical resolved shear stress law, though crystals containing θ' particles deformed by multiple slip in the same manner as that previously found for overaged crystals. ***D. Dew-Hughes and W. D. Robertson.*** *Acta Metallurgica,* v. 8, Mar. 1960, p. 156-167.

13619 The Effect of Solute Precipitation on the Resistivity of Alloys. The effect of clustering upon the residual resistivity of alloys is treated using a free-electron model. The effects of lattice strain are taken into account as a change in the effective valence of the solute. ***W. A. Harrison.*** *Acta Metallurgica*, v. 8, Mar. 1960, p. 168-171.

13620 Tensile Deformation of Aluminum Single Crystals at Low Temperatures. Tension tests on aluminum single crystals of several axial orientations were made at 4.2, 77, 200, and 273 K. The hardening rate passed through a maximum and then decreased continuously with increasing stress, the decrease being less rapid at the lower temperatures. ***W. F. Hosford, Jr., R. L. Fleischer, and W. A. Backofen.*** *Acta Metallurgica*, v. 8, Mar. 1960, p. 187-199.

13621* Effects of Vanadium on the Properties of Commercial Nickel-Based Alloys. The 1.5 to 2 times increase of the plasticity of Monel metal and constantan at 400-800 C makes it possible to decrease or fully eliminate the temperature zones of brittleness of Ni alloys by alloying them with small amounts of V and some other rare metals. (*In Russian.*) Vliianie vanadiia na svoĭstva promyshlennykh splavov na osnove nikelia. ***E. M. Savitakiĭ and U. K. Duisemaliev.*** *Akademiia Nauk Kazakhskoĭ SSR, Vestnik*, v. 16, no. 6, June 1960, p. 43-47.

13622 Notes on Mechanical Testing Techniques at Very Low Temperatures. Discusses hardness tests, impact tests, tensile tests, fatigue tests, torsion testing and strain measurement at low temperatures. ***James E. Campbell.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 43, Feb. 19, 1960, 8 pp. (TN799 B32.2d Contin.)

13623 Current Tests for Evaluating Fracture Toughness of Sheet Metals at High Strength Levels. Describes procedures used primarily for alloy steels, but which may be used for high-strength Ti and Al alloys and other metals. These tests involve tensile loading of notched specimens; bending of flat and notched specimens; impact loading of notched specimens; bulging of unnotched, notched, and welded specimens; and combinations of tensile loading and internal pressuring of cylindrical specimens. ***J. E. Campbell and W. P. Achbach.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 124, Jan. 28, 1960, 66 pp. (TN799.T5 B32.7t Vis.)

13624 Physical and Mechanical Properties of Columbium and Columbium-Base Alloys. Columbium has good potential as an alloying base because of its low neutron-capture cross section and high melting point, and related potential high-temperature strength. Pure Cb is soft and ductile above 1600 F but elevated-temperature strengthening is accomplished by solid-solution-strengthening and dispersion-hardening mechanisms. ***E. S. Bartlett and J. A. Houck.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 125, Feb. 22, 1960, 62 pp. (TN799.T5 B32.7t Vis.)

13625 Structural Damage in Thermally Cycled René 41 and Astroloy Sheet Materials. Stress-rupture life at 1650 F and tensile properties at room temperature and at 1400 F were used to determine the extent of structural damage. ***D. P. Moon, J. A. VanEcho, W. F. Simmons, and J. F. Barker.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 126, Feb. 29, 1960, 24 pp. (TN799.T5 B32.7t Vis.)

13626 Physical and Mechanical Properties of Tungsten and Tungsten-Base Alloys. In an appraisal of mechanical properties, the effects of the ductile-brittle transition and of recrystallization must usually be taken into account. Tensile properties of W up to the melting point were measured. Physical properties of W were fairly well established as the result of developments in the lamp and electron tube industries. ***V. D. Barth.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 127, Mar. 15, 1960, 60 pp. (TN799.T5 B32.7t Vis.)

13627 Physical Properties of Some Nickel-Base Alloys. Compiles data on the properties of 33 representative Ni-base alloys. The report is divided into two main sections. The first is a tabulation of the chemical compositions, in which the alloys are classified into six groups according to the major alloying elements: Ni-Cu, Ni-Si, Ni-Cr, Ni-Cr-Fe, Ni-Cr-Co, and Ni-Mo. The second section contains definitions of the terms used to describe the physical properties, the status of available data, and data sheets and graphs for each of the representative alloys. ***M. E. Langston and C. H. Lund.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 129, May 20, 1960, 146 pp. (TN799.T5 B32.7t Vis.)

13628 Selected Short-Time Tensile and Creep Data Obtained Under Conditions of Rapid Heating. Presents a graphical presentation of stress-versus-temperature curves of tensile strength, yield strength, and stress to produce 1% creep strain or rupture in designated times. Gives data for 28 alloys of general interest. Includes a bibliography. ***Donald P. Moon and Ward F. Simmons.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 130, June 17, 1960, 88 pp. (TN799.T5 B32.7t Vis.)

13629 Detection of Slaty Fracture in [Alloy Tool] Steels. Tempering at 450-500 C after the usual quenching increases tendency to slatiness of the fracture. ***N. S. Fedotenko.*** *Henry Brutcher Translation No.* 4694, 3 pp. + 1 figure. (From *Zavodskaya Laboratoriya*, v. 22, no. 7, 1956, p. 855-856.) Henry Brutcher, Altadena, Calif.

13630 Damage to Metals in Creep. Discusses theories to explain the loss of strength of metals under prolonged stress, with special emphasis on the author's theory that damage in creep is due to the coalescence and "precipitation" of vacant lattice sites at the surface of micropores, subsequently developing into microfissures. ***V. V. Burdukskii and I. A. Oding.*** *Henry Brutcher Translation No.* 4834, 9 pp. (From *Izvest. Akademii Nauk SSSR, OTN*, no. 5, May 1956, p. 147-151.) Henry Brutcher, Altadena, Calif.

13631 Effect of Additional Alloying Elements Upon Steel Properties. Effect of W, Ti, Cb, Ni, B, and V on tensile strength, impact toughness, and hardness. ***M. P. Braun.*** *Henry Brutcher Translation No.* 4869, 4 pp. + figures. (From *Izvest. VUZ-Chern. Met.*, no. 4, Apr. 1960, p. 190-193.) Henry Brutcher, Altadena, Calif.

13632* Investigations of the Magnetism of Alloys of the Cr-Ge System. From 50 to 95 at.% Ge was contained in the microsections examined. The alloys were ferromagnetic from 77 to 110 K and had a Curie temperature between 100 and 110 K. Only one phase was ferromagnetic and, very probably, was close to $CrGe_2$ in its chemical composition. (*In Russian.*) Magnitnye issledovaniia splavov sistemy Cr-Ge. ***S. D. Margolin and I. G. Fakidov.*** *Fizika Metallov i Metallovedenie*, v. 9, no. 6, June 1960, p. 823-827.

13633 Determination of the Modulus of Elasticity in Chromium Carbide-Nickel Alloys. The elasticity modulus as a function of concentration in Cr_3C_2-Ni alloys was examined when from 5 to 40% Ni was contained. By extrapolation, the modulus of elasticity of pure Cr_3C_2 is 3.8×10^{10} kg/cm^2. An empirical formula is proposed permitting the calculation of the modulus. (*In Russian.*) Opredelenie modulia uprugosti splavov karbid khroma-nikel'. ***P. I. Mel'nichuk, V. N. Klimenko, and A. B. Liashchenko.*** *Fizika Metallov i Metallovedenie*, v. 9, no. 6, June 1960, p. 918-921.

13634 The Mechanical Properties of Some Ductile Niobium and Tantalum Base Alloys Prepared by Electron Beam Melting. Using impact transition temperature as a criterion for initial evaluation, a number of alloys were studied in high-temperature tensile and creep-rupture tests as well as fabrication studies. These data are being obtained at the present time, and more complex modifications of these alloys are being explored. ***H. R. Smith, Jr., J. Y. K. Hum, A. Donlevy, and C. d'a. Hunt.*** *Journal of the Less-Common Metals*, v. 2, nos. 2-4, Apr.-Aug. 1960, p. 69-75.

13635 The Physical Properties of Niobium, Tantalum, Molybdenum and Tungsten. Physical properties Nb, Ta, Mo, and W are reviewed in relation to the properties of the other elements of groups IVa, Va, and VIa of the periodic table. Zone-refined specimens of Nb and Ta were prepared, and resistivity, magnetic susceptibility, and thermal e.m.f. measurements made in the temperature range 10-295 K. ***B. B. Argent and G. J. C. Milne.*** *Journal of the Less-Common Metals*, v. 2, nos. 2-4, Apr.-Aug. 1960, p. 154-162.

13636 Compression Creep Tests on Niobium at High Temperatures. Details are given of a machine for measuring creep in compression at high temperatures in a vacuum of about 10^{-6} mm of Hg. The design is such that the maximum temperature of testing is limited mainly by the creep strength of the push rods; rods of recrystallized alumina are satisfactory at 1,200 C. Creep curves are given for a commercial grade of Nb. ***G. Brinson.*** *Journal of the Less-Common Metals*, v. 2, nos. 2-4, Apr.-Aug. 1960, p. 272-276.

13637 Mechanical Properties of Intermetallic Compounds. A symposium of the Electrothermics and Metallurgy Division of The Electrochemical Society held in Philadelphia, May 3-7, 1959. Papers discuss phenomenology of mechanical behavior, theoretical and experimental investigations of particular properties, and experimental techniques for preparation and study. Includes an extensive review of the literature. ***J. H. Westbrook, editor.*** 435 pp. 1960. John Wiley & Sons, New York. (TN673 EL25m)

13638* Creep Resistance of Titanium-Containing Zinc Alloys. Titanium as an alloy constituent in Zn alloys increases the creep strength and displaces the recrystallization towards higher temperatures. The absence of secondary recrystallization up to higher temperatures closely below the melting point is striking. Small Ti additions are sufficient to cause these favorable properties to develop. (*In German.*) Dauerstandverhalten titanhaltiger Zinklegierungen. ***B. Trautmann.*** *Metall*, v. 14, Aug. 1960, p. 780-781.

13639* Theoretical Study of Strain Hardening on the Basis of a Dislocation Model. The internal stresses in a crystal are assumed to arise essentially from the presence of a tridimensional network of dislocations. Two types of stresses are evaluated: instant elastic stress between reciprocally opposing dislocations and stresses due to the recombination of reciprocally attracting dislocations. It is shown that the recombination plays the main role in hardening. (*In French.*) Etude théorique de l'écrouissage à partir d'un modèle de dislocations. ***G. Saada.*** *Métaux Corrosion-Industries*, v. 35, July-Aug. 1960, p. 265-289.

13640 Properties of Hydrided Zirconium. The properties of hydrided zirconium at hydrogen contents up to 1.1% H are presented. The properties reported consist of density and tensile strength and hardness from room temperature to 1600 F, creep and stress rupture from 800 to 1600 F, linear thermal expansion from room temperature to 1400 F, specific heat from 32 to 1400 F, and thermal conductivity and electrical resistivity from 100 to 1000 F. ***D. S. Parker and C. L. Huffine.*** *U. S. Atomic Energy Commission, APEX-561*, Dec. 1959, 38 pp. (UF767 Un3.1ap Contin.)

13641* The Embrittlement of Copper by Means of Hydrogen. Conditions of embrittlement of Cu were studied at annealing temperatures; practical investigations were conducted first on a reclaimed Cu billet, then on bars artificially treated with gas; chemical and metallographic examinations were made on the bars and on rolled and drawn products obtained from them. (*In German.*) Aus der Praxis der Versprödung von Kupfer durch Wasserstoff. ***Otto Nielsen.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 13, Aug. 1960, p. 381-387.

13642* Resistometric Investigation of the Influence on Lattice Vacancies on the Age Hardening of Aluminum-Zinc Alloys. The quenching speed was 200°/sec. The age-hardening was accelerated with increasing homogenizing temperature up to 400 C, at higher temperatures the trend was reverse. The inversion temperature is in a first approximation independent of the aging temperature and decreases with increasing content of Zn. (*In German.*) Resistometrische Untersuchung des Einflusses von Fehlstellen auf die Kaltaushärtung von Aluminium-Zink-Legierungen. ***Werner Köster and Gernot Hofmann.*** *Zeitschrift für Metallkunde*, v. 51, June 1960, p. 303-313.

13643* The Magnetic Analysis of an Iron Single Crystal. It is shown how the magnetic induction of an iron single crystal may be measured by the Lorentz-effect of an electron beam. (*In German.*) Zur magnetischen Analyse eines Eiseneinkristalls. ***Shigeto Yamaguchi.*** *Zeitschrift für Metallkunde*, v. 51, June 1960, p. 340-341.

13644* The Coercive Force of Nickel and of Iron-Nickel Alloys on Plastic Deformation. The coercive force of single crystals and polycrystals of Ni and cubic fcc. Fe-Ni alloys was measured as dependent on plastic deformation. The coercive force of the single crystals as a function of flow stress has three regions of different slope, which correspond to the three regions of the work-hardening curve. (*In German.*) Die Koerzitivkraft von Nickel und Eisen-Nickel-Legierungen bei plastischer Verformung. ***Eckart Kneller and Gerd Schmelzer.*** *Zeitschrift für Metallkunde*, v. 51, June 1960, p. 342-349.

13645* Conductivity and Hall Constant. X. The Co_3V-Ni_3V-Pd_3V System. The constitutional diagram of the systems Ni_3V-Pd_3V, Co_3V-Pd_3V, and Co_3V-Ni_3V-Pd_3V, respectively, are established by different measurement methods. The dependence of some properties in these systems versus the concentration is investigated. In the ternary system, the border lines of a concentration band are determined in which the electrical resistance increases because of the formation of an order state, instead of decreasing as observed outside of this area. (*In German.*) Leitfähigkeit und Hallkonstante. XI. Das System Co_3V-Ni_3V-Pd_3V. ***Werner Köster and Werner Gmöhling.*** *Zeitschrift für Metallkunde*, v. 51, July 1960, p. 385-391.

See also: **13537** (creep of a thick-walled cylinder); **13542** (strength of concrete-reinforcing steel bars); **13578** (properties of air and vacuum-melted steels and superalloys); **13655** (properties of Mo sheet).

METALS—MECHANICAL WORKING

13646 Helixform Bevel and Hypoid Gears. Gears made by this method are classified as nongenerated which means that the workpiece remains at rest while the teeth are being cut. It is a process especially adapted to high production and accurate machining and is the method used to manufacture most automotive spiral bevel and hypoid gears. Pinions which match nongenerated gears are produced with generating motion. The tools cutting the teeth of the pinion are mounted on a machine element which, while the teeth are being cut, turns in concord with the turning of the pinion on its axis. ***G. M. Spear, C. B. King, and M. L. Baxter, Jr.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 179-190.

13647 The Deformation Process in Metal-Cutting. An analysis of the orthogonal chip process for a strain-hardening material is presented together with a qualitative evaluation of the effects of temperature increases and of flank rubbing. An expression is derived for the average stress on planes through the tool point ahead of the shear plane. ***W. J. McDonald and B. F. Murphey.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 3, Aug. 1960, p. 253-258.

13648 Roll-Force and Torque Coefficients for Hot-Strip Steel Mill. An analytical and computer investigation was made to determine the numerical coefficients involved in the roll-force and roll-torque equations pertaining to a single stand in a multistand, tandem, steel rolling mill. ***B. N. Garudachar and H. A. Peterson.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 3, Sept. 1960, p. 683-688.

13649* Diffusion Processes in the Zones of Contact Between the Material of Blanks to Be Machined and Carbide Tools During Turning. Diffusion occurring during the dipping of carbides with different Co and Ti carbide contents into steel melts with 0.04 or 0.66% C, or into a cast iron melt with 3.2% C, and after a two-hour annealing process were studied metallographically. Tungsten carbides are attacked by Fe at 800 C. A new carbide phase is produced at 1000 C. (*In German.*) Diffusionsvorgänge an den Berührungszonen zwischen Werkstückstoff und Hartmetallwerkzeugen beim Drehen. ***Ferdinand Altenwerth.*** *Archiv für das Eisenhüttenwesen*, v. 31, no. 7, July 1960, p. 433-439.

13650 Department of Defense Titanium Sheet-Rolling Program. Summarizes the progress made in the program from Jan. 1, 1959, through Dec. 1959. During this period, production of heat-treatable alloys was completed by one producer and is nearing completion by the other two producers. Three new alloys were added to the program, Ti-7Al-12Zr, Ti-8Al-1Mo-1V,

and Ti-8Al-8Zr-1(Cb + Ta). These are designed to be weldable alpha alloys with high creep strength. ***H. R. Ogden.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 46H, June 1, 1960, 72 pp. + appendix. (TN799.T5 B32.7t Vis.)

13651 Machining of Forging Dies by the Electrospark Process. Sequence of steps in the production of forging dies; electrospark machining of the die impression; best conditions for electrospark rough, intermediate, and finish machining of dies. ***E. A. Volodin.*** *Henry Brutcher Translation No.* 3477, 8 pp. + 5 figures. (Abridged translation from *Vestnik Mashinostroeniya*, v. 28, no. 6, 1949, p. 49-52.) Henry Brutcher, Altadena, Calif.

13652 Tool Life Lengthened by High-Pressure Spraying of Cutting Fluid. The wear of the cutting face substantially affects the quality of the machined surface, and this quality was better, over the whole range of tip wear, with spray than with normal cooling. ***A. V. Pakhomov.*** *Henry Brutcher Translation No.* 4556, 4 pp. + 3 figures. (From *Vestnik Mashinostroeniya*, v. 38, no. 2, 1958, p. 55-56.) Henry Brutcher, Altadena, Calif.

13653* What to Look for in Chemical Cutting and Grinding Fluids. Properties of coolants and their components, including their effects upon machinery and cutting tools. ***Peter W. Sherwood.*** *Carbide Engineering*, v. 12, Aug. 1960, p. 18-19.

13654* Radioactive Apparatus for Measuring the Thickness of Hot Sheet Metal Between 5 and 50 mm. Describes a γ-ray gage having an accuracy of $\pm$ 0.1 mm and a speed of one measurement per sec. (*In Russian.*) Pribor dlia izmereniia tolshchiny tolstolistovogo goriachego prokata. ***B. N. Vasil'ev, V. K. Latyshev, Iu. S. Pliskin, and A. K. Felinger.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 19 pp. (QC770 C76pr)

13655 The Effect of Rolling Temperature on the Mechanical Properties of Molybdenum. Shows the effect of initial breakdown at 1350 or 1000 C and final rolling at 1000, 800, 600, or 400 C on the mechanical properties of arc-melted Mo. Presents tensile, impact, and slow-bend test results and illustrates the influence of stress relief and recrystallization. Discusses the bearing of these results on the production and properties of strip and sheet. ***J. A. Belk, E. W. Ward, A. J. Nicol Smith, and J. M. Clyne.*** *Journal of the Less-Common Metals*, v. 2, nos. 2-4, Apr.-Aug. 1960, p. 86-94.

13656* Methods of Grinding Mass Produced Precision Rings. In external grinding, the rings are set on the external surface on two swivelling pads with the face against a rotating face plate, to which they are pressed by two rollers mounted on a special swivelling bracket. In internal grinding, the ring is mounted on two pads and pressed with its locating face against the rotating face plate by two rollers. ***M. P. Merpert and Yu. S. Reibakh.*** *Machines and Tooling* (Translation of *Stanki i Instrument*), v. 31, no. 4, Apr. 1960, p. 23-26.

13657* Metal-Cutting Bibliography, 1943-1956. The term "metal cutting" is considered to embrace only those operations which result in the formation of chips—turning, drilling, milling, etc. Such nonchip-producing processes as shearing, O cutting, and chemical milling are excluded from consideration. However, sufficient flexibility is allowed in the definition of "chip formation" to permit inclusion of several cutting processes where no definite agreement exists with regard to their chip-forming characteristics. Such processes include friction sawing, fine grinding, ultrasonic machining, and the various electroerosion processes, all of which are covered. Unpaged. 1960. American Society of Tool and Manufacturing Engineers, Detroit. (Z5853.M2 Am35m Ref.)

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

13658* X-Ray Diffraction Studies of the δ Phase, Mo-Ni. Single-crystal X-ray diffraction studies of the δ phase, Mo-Ni (61.1 weight per cent Mo) show that it is at least pseudotetragonal, with $a_o = 9.108$, $c_o = 8.852$ Å, and extinctions suggesting space group D_4^6-$P4_22_12$. All attempts to determine the structure in detail were unsuccessful. ***Clara B. Shoemaker, Alwyn H. Fox, and David P. Shoemaker.*** *Acta Crystallographica*, v. 13, pt. 8, Aug. 10, 1960, p. 585-587.

13659 Effect of Pressure on Intermetallic Layer Growth. Examines theoretically the effect of hydrostatic pressure on the kinetics of intermetallic layer growth in interdiffusing three-phase two-component systems. Derives an equation which enables one to estimate the relative importance to intermetallic layer growth of pressure-induced changes in the diffusion coefficient and pressure-induced shifts in the interface boundary concentrations. ***L. S. Castleman.*** *Acta Metallurgica*, v. 8, Mar. 1960, p. 137-146.

13660 The Interaction of Dislocations and Precipitates. Thin foils of various aged aluminum alloys were examined by transmission in the electron microscope. Dislocations, introduced by rolling before thinning, were observed to move under the action of thermally induced stresses. The interactions of these dislocations and precipitates were studied and the results show that dislocations pass through zones, coherent and partially coherent precipitates, but not through incoherent precipitates. ***R. B. Nicholson, G. Thomas, and J. Nutting.*** *Acta Metallurgica*, v. 8, Mar. 1960, p. 172-176.

13661 An X-Ray Structure Investigation of the Liquids of Sodium, Potassium and Sodium-Potassium Alloys. By using a reservoir technique, a plane horizontal surface of liquid metal was examined by a monochromatic X-ray beam in a focusing Geiger diffractometer. The radial distribution method of analysis was used to interpret the results. None of the liquids examined show evidence of structure other than that associated with a statistical mixture of atoms. ***B. R. Orton, B. A. Shaw, and G. I. Williams.*** *Acta Metallurgica*, v. 8, Mar. 1960, p. 177-186.

13662 Transformations in the β and ζ Phases of the Silver-Zinc Alloys. Values obtained at various rates of heating and cooling in the temperature range 210-340 C are given. The transformation $\zeta \rightarrow \beta$ takes place by breakdown of the ζ structure to give a partially ordered β structure which subsequently disorders. ***W. J. Kitchingman and J. I. Buckley.*** *Acta Metallurgica*, v. 8, June 1960, p. 373-376.

13663* Study of a Partial Constitution Diagram of Titanium-Aluminum-Chromium-Iron-Silicon. Investigation of the part of the system in the region of solid solutions based on Ti. The spatial representation of this system revealed the region of distribution of the solid solutions and of the phase areas neighboring them. A polythermal section of the system of α-solid solution with a modified content of Al with a constant content of Cr (0.5%), Fe (0.5%), and Si (0.5%) was studied. (*In Russian.*) Izuchenie chastichnoĭ diagrammy sostoianiia titan-aliuminiĭ-khrom-zhelezo-kremniĭ. ***I. I. Kornilov, V. S. Mikheev, and T. S. Chernova.*** *Akademiia Nauk SSSR, Otdelenie Tekhnicheskikh Nauk, Izvestiia, Metallurgiia i Toplivo*, 1960, no. 3, May-June, p. 70-72 + 1 plate.

13664 The Precipitation of Carbon From Alpha-Iron. I. Electronmicroscopic. II. Kinetics. The first carbide phase that precipitates at 120 C from α Fe containing about 0.02 wt% C was studied with the electron microscope. In both strained and unstrained material the carbide particles appeared to form on the dislocations in the Fe. The structure of the carbide was tentatively identified as an expanded α-Fe lattice (body-centered tetragonal) with about 0.7 wt% C. ***R. H. Doremus and E. F. Koch.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 4, Aug. 1960, p. 591-605.

13665 Observation of Slip, Twinning, and Cleavage in Iron-Phosphorus Solid Solutions. The deformation mechanisms of α iron-phosphorus alloys were compared at 20 and −196 C. Alloying with P increases the resistance to slip, but has little effect on the resistance to twinning. The stress for onset of twinning is nearly independent of temperature, but there is an increasing tendency for cleavage along [112] twin boundaries with decreasing temperature and increasing P content. ***E. Hornbogen.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 4, Aug. 1960, p. 634-635.

13666 The Gamma to Epsilon Transformation in Zr 20 to 70 Wt Pct U Alloys. The γ-to-ε transformation was studied in Zr alloys containing 22 to 70 wt% U. In this range of compositions the γ phase can be retained by quenching. Transformations to ε occurs by a nucleation-and-growth process. The diffusion of atoms to preferred lattice sites to yield a partially ordered structure apparently controls the rate of reaction. ***A. A. Bauer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 4, Aug. 1960, p. 636-644.

13667* Low Copper Brasses. Problems of the γ Phase. The γ phase range does not appear in the equilibrium system corresponding to low copper brasses in which the ratio of Cu:Zn >1. The appearance of some separations of the γ phase in these alloys is caused by the segregation of the alloying components. Small separations of the γ phase do not disqualify the alloys causing a relatively small decrease in their properties. (*In Polish.*) Mosiadze niskomiedziowe. Zagadnienie fazy γ. ***Czesław Adamski.*** *Archiwum Hutnictwa,* v. 5, no. 1, 1960, p. 3-60 + 3 plates.

13668 Diffusion Rates and Solubilities of Interstitials in Refractory Metals. This report gives equations for diffusion rates of O, N, C, and H in Cb and Ta, and diffusion rates of N, C, H, and B in Mo and W. Solubilities of C, N, O, and H in W, Ta, Mo, Cb, V, and Cr are also given. ***W. D. Klopp and Vincent D. Barth.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 50, Apr. 4, 1960, 10 pp. (TN799 B32.2d Contin.)

13669 Method of Studying the Chemical Heterogeneity of Steel Ingots. Discusses a procedure for selection of drilling sides, plotting analysis results on reproduction of ingot section, correspondence of C distribution with pattern of crystal structure. ***S. Ya. Skoblo.*** *Henry Brutcher Translation No.* 4835, 4 pp. + 3 figures. (From *Izvest. VUZ-Chern. Metal.*, no. 10, Oct. 1959, p. 191-193.) Henry Brutcher, Altadena, Calif.

13670 Effect of Cooling Rate on the Stability [and Chemical Homogeneity] of 75% Ferrosilicon. Gives results of investigation of segregation of elements in slowly cooled 75% ferrosilicon. ***Yu. P. Vasin.*** *Henry Brutcher Translation No.* 4856, 4 pp. + 3 tables. (From *Izvest. VUZ-Chern. Met.*, no. 11, Nov. 1959, p. 43-46.) Henry Brutcher, Altadena, Calif.

13671* The Kinetics of Oxidation of Iron-Sulfur Alloys at High Temperatures in Hydrogen and Water Steam Atmospheres. The kinetics studied present a linear phase of oxidation followed by a parabolic phase. The linear oxidation is interpreted as an interface reaction limited by the chemical adsorption of O on the oxide. (*In French.*) Sur la cinétique d'oxydation des alliages fer-soufre aux températures élevées dans des atmosphères d'hydrogène et de vapeur d'eau. ***Christian de Beaulieu, Michel Cagnet, and Jean Moreau.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 22, May 30, 1960, p. 3644-3646.

13672* Determination of the Thermodynamic Activity of Antimony in Alpha-Iron. A study was made of the equilibrium in the distribution of Sb between Fe and liquid Pb. In one case, 13 specimens were held during periods between 12 and 48 hours at 759 C; the Sb concentrations in a melt with Pb were 1% and 2%, the Sb concentrations in Fe were from 0.85% to 1.98%. In the case of the distribution of Sb between liquid Pb and α-Fe, the temperature varied from 759 to 877 C, the Sb concentrations in Pb varied from 1% to 2%, and in Fe from 1% to 2.53%. (*In Russian.*) Opredelenie termodinamicheskoĭ aktivnosti sur'my v al'fa-zheleze. ***I. A. Tomilin.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 11 pp. (QC770 C76pr)

13673* Diffusion, Recrystallization and Phase Transformations. The use of radioactive isotopes in connection with some important features of elementary processes in metals revealed that the formation of new grains during recrystallization and also during polymorphous transformation is not connected with the migration of the atoms of the boundaries of the initial grains at a considerable distance, and consequently the transformation of the grain boundaries during recrystallization and during their subsequent growth is not linked with the usual diffusion mechanism. On the other hand, the dependency of the speed of diffusion on the structural factors such as phase conversions (eutectoid transformation in steel), structural changes (transformation of α'-Ti into α-Ti), the type of crystalline structure of the metal (α- and β-Ti), and also on the field of force created by external charge was noticed. (*In Russian.*) Diffuziia, rekristallizatsiia i fazovye prevrashcheniia. ***S. Z. Bokshteĭn, M. A. Gubareva, S. T. Kishkin, and L. M. Moroz.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 12 pp. (QC770 C76pr)

13674* Study of the Diffusion and Solubility of Various Ingredients in Germanium. Radioactive isotopes were used in studying Ag, Fe, Cd, Ta, and Te in Ge. The interval of temperature involved was between 700 and 940 C. Within this range, Ag diffuses in Ge in the form of positive ions of a single charge. The amount of evaporation of Ge in Te vapors was determined. The results of the investigation coincided with the diffusion theory of Bert-Ziner-Svelin. (*In Russian.*) Issledovanie diffuzii i rastvorimosti nekotorykh primeseĭ v germanii. ***E. G. Miselink, V. E. Kosenko, L. A. Khomenko, and V. D. Ignatkov.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 12 pp. (QC770 C76pr)

13675 The Effect of Chemical Composition on the Shape of Martensite Transformation Curves. The Greninger-Troiano technique was used to determine curves of % martensite vs temperature for a number of iron-nickel-carbon, and iron-chromium-carbon steels. All the curves showed a linear region between about 5 and 55% transformation. The increment of transformation per °C in the linear range was found to be directly proportional to the M_s temperature, i.e., the increment of transformation per °C is proportional to the change in the thermodynamic driving force per °C. ***R. Brook, A. R. Entwisle, and E. F. Ibrahim.*** *Iron and Steel Institute, Journal,* v. 195, pt. 3, July 1960, p. 292-298.

13676* Interaction of Titanium With Nitrogen and Hydrogen in Molten Steel. In molten steel, Ti reacts energetically with N, forming Ti nitrides of a composition, whatever the relationship between Ti and Ni in steel, close to the stoichiometric type. Titanium nitrides are formed when the Ti content in the molten steel exceeds the double C content. These nitrides can float up in the slag, where they are identified as an independent phase. This is especially the case at 1560 C and below. (*In Russian.*) Vzaimodeistvie titana s azotom i uglerodom v zhidkoi stali. ***Iu. G. Gurevich.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Chernaia Metallurgiia,* 1960, no. 6, p. 59-67.

13677* Effects of Small Tungsten Additions on the Autodiffusion of Iron. Diffusion processes in Fe alloys with 0.1, 0.35, 0.6, 0.76 and 1.2 wt.% W between 900 and 1300 C were studied. Radioactive isotope Fe^{59} was used as an indicator. By removing the layers and measuring the interval activity, the coefficients of self-diffusion of Fe, the energy of activation of self-diffusion and the relationships of concentration were determined. (*In Russian.*) O vliianii malykh primeseĭ vol'frama na samodiffuziiu zheleza. ***V. V. Sanadze and K. G. Tatrishvili.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Fizika,* 1960, no. 3, p. 93-96.

13678* Effects of Plastic Deformations on the Phase Transformations in Silicon and Nickel Steels. The magnetic method revealed that in plastic deformation of steels alloyed with Si and Ni, of an initial structure consisting of α + Fe_3C, phase transformations are possible. As a result, cementite passes into the interstitial carbide χ Fe_xC (Curie Point θ = 260-265 C). This carbide, beyond 400 C, becomes unstable and begins to disappear at 600 C. Decrease in the delay of grafitization in steel was studied. (*In Russian.*) Vliianie plasticheskoĭ deformatsii na fazovye prevrashcheniia v kremnistykh i nikelevykh staliakh. ***Iu. A. Sysuev, E. V. Vasil'eva, and M. A. Krasil'nikova.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Fizika,* 1960, no. 3, p. 218-222.

13679* On Sodium Diffusion Into Fluid Lead. The usefulness of the capillary method for the investigation of the velocity of diffusion of Na from a Pb-Na alloy into fluid Pb was shown. Values of the coefficient of diffusion of Na into Pb at 400, 500 and 600° were determined. (*In Russian.*) O diffuzii natriia v zhidkiĭ svinets. ***A. G. Morachevsky, E. A. Cherepanova, and A. F. Alabyshev.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, TSvetnaia Metallurgiia,* 1960, no. 3, p. 70-73.

13680* The Effect of Alloying Elements on Interatomic Cohesion and Lattice Distortion in Solid Aluminum Base Solution. (*In Russian.*) Vliianie legiruinshchikh primeseĭ na sily mezhatomnoĭ sviazi i iskazheniia reshetki v tverdykh rastvorakh na osnove aliuminiia. ***G. P. Kushta and I. P. Mikhaylyuk.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, TSvetnaia Metallurgiia,* 1960, no. 3, p. 139-142.

13681 Solubility of Gold in Mercury. Explains the faulty reasoning behind this popular misconception by a number of references, all but one claiming intensive solubility. Goes on to show that the Au is only "met" by Hg (solubility of Au in Hg is only about 0.14%). Some solid intermetallic Au-Hg alloys are discussed. ***John B. Brown.*** *Journal of Chemical Education,* v. 37, Aug. 1960, p. 415-416.

13682* Spiral Growth of Lamellar Single Crystal of Colloidal Gold. The lamellar single crystal of colloidal Au, prepared by the reduction of aqueous solution of auric chloride with salycilic acid at room temperature, sometimes shows a couple of growth spirals, which appear at the same time on two lamellar habit surfaces of a crystal. The three-dimensional configuration of the crystal with spiral steps was confirmed by the replica technique of the electron microscopy. ***Eiji Suito and Natsu Uyeda.*** *Journal of Electronmicroscopy,* v. 8, 1960, p. 25-30.

13683* A Technique for Replicating Single Crystal Iron Whiskers for Electron Microscopy. The problems of replicating single-crystal Fe whiskers having faces 50-200 microns in width were solved utilizing a single-stage, preshadowed C replica. By proper release of the replica from the specimen, a continuous replica free of cracks is produced and the orientation of the surface microstructure with respect to the whisker axis is maintained. ***Ronald L. Scott.*** *Journal of Electronmicroscopy,* v. 8, 1960, p. 31-37.

13684 Niobium and Tantalum Alloys. Recently published work on Nb and Ta alloys is reviewed, followed by a consideration of the strain energies associated with solid solution formation in some binary systems, which shows that the strain energy contribution may account for differences in alloying behavior between certain Nb and Ta alloys. Finally, original work on several Nb and Ta systems is described. ***A. G. Knapton.*** *Journal of the Less-Common Metals,* v. 2, nos. 2-4, Apr.-Aug. 1960, p. 113-124.

13685 The Phase Constitutions of Some Niobium-Bearing and Associated Transition Metal Systems. A constitutional survey is given of Ni-bearing ternary systems, several of which were determined, and the underlying principles are discussed in some of their broader aspects. The systems represent substantially solid-solution and compound-controlled types. ***H. J. Goldschmidt.*** *Journal of the Less-Common Metals,* v. 2, nos. 2-4, Apr.-Aug. 1960, p. 138-153.

13686 The Annealing of Worked Tungsten. Structural changes occurring during the annealing of worked W were followed using the transmission electron microscopy technique. It is suggested that the technique could be used as a means of studying the effect of additions on the recrystallization process. The observations are related to the brittleness of W. ***F. O. Jones.*** *Journal of the Less-Common Metals,* v. 2, nos. 2-4, Apr.-Aug. 1960, p. 163-171.

13687 The Lattice Spacings of Thorium-Lanthanum Alloys. The lattice spacing/composition curve for the Th-La alloy system was investigated, for comparison with previous work on the Th-Ce system. The results indicate that face-centered cubic Th and La form a complete series of solid solutions; the experimentally determined lattice spacings lie on a smooth and continuous curve, except for a narrow range of composition from about 52 to 60 at% La, in which erratic results may be obtained. The reason for the scatter at these compositions is thought to lie in an enhanced solubility of N in the alloys. The lattice spacing curve obtained is not of the same form as that for the Th-Ce alloys, and the reason for this is discussed in terms of the relative ease with which Ce may change its effective valency in solid solution. ***D. S. Evans, G. V. Raynor, and R. T. Weiner.*** *Journal of Nuclear Materials,* v. 2, no. 2, June 1960, p. 121-128.

13688* Revealing Dislocations in Calcite Crystals. The selective etching method revealed dislocations in natural calcite crystals which are not subject to plastic deformations. The direction of the dislocation lines were [11$\bar{2}$]. Dislocations occurred along the boundaries between the twin layer and the crystal matrix. Etching streaks also were observed. (*In Russian.*) Vyiavlenie dislokatsiĭ v kristallakh kal'tsita. ***V. Z. Bengus, F. F. Lavrent'ev, L. M. Soifer, and V. I. Startsev.*** *Kristallografiia,* v. 5, no. 3, 1960, p. 441-445 + 1 plate.

13689* Some Properties of the Material Combination of Steel With Titanium Carbide Film. Microscopic examinations revealed that Ti carbide films grow without the formation of a larger diffusion layer on steel and cast iron, and that the graphite of cast iron takes part in a solid form in the carbide formation. When the Ti carbide films separate, the surface roughness of the parts treated increases. (*In German.*) Einige Eigenschaften der Werkstoffkombination Stahl mit Titankarbidüberzug. ***H. Wiegand and W. Ruppert.*** *Metalloberfläche,* v. 14, Aug. 1960, p. 229-235.

13690 Direct Observation of Defects in Evaporated Silver. Single-crystal films of Ag were made by evaporation of Ag onto the cleavage surface of a heated rock-salt crystal. The crystalline defects present in the detached films were studied by transmission electron microscopy. In fresh areas of the foil, numerous simple stacking faults confined to a single plane were observed. The interaction of the faults to form complex faults on several planes, and the effects of holes and dislocations were studied. ***V. A. Phillips.*** *Philosophical Magazine,* v. 5, ser. 8, June 1960, p. 571-583.

13691 The Generation of Vacancies in Metals. The regions where injected He atoms first appear as gas bubbles are those where thermal vacancies originate. Microscopic examination of metals, injected with He by using them as targets for energetic α-particles, reveals grain boundaries as the principal suppliers of vacancies. ***R. S. Barnes.*** *Philosophical Magazine,* v. 5, ser. 8, June 1960, p. 635-646.

13692 Submicroscopic Structure of Electrolytic Copper Precipitates. Without inhibitors the grain structure and distortions (dislocations) of the base are reproduced, cathode-active additives are included in cavities of various size and of high and nearly constant density. Internal stresses are due to interactions with dislocations. These growth faults determine the properties of deposits, on the other hand they are consequences of electrochemical processes near and at the phase boundary. (*In German.*) Submikroskopische Struktur galvanischer Kupferniederschläge. ***S. Steinemann and H. E. Hintermann.*** *Schweizer Archiv für angewandte Wissenschaft und Technik,* v. 26, May 1960, p. 202-210.

13693 Research Investigation to Determine the Optimum Conditions for Growing Single Crystals of Selected Borides, Silicides and Carbides. Most artificial single crystal boules of TiB_2 and WSi_2 cracked upon cooling. Dimolybdenum carbide boules had large sections of a "single crystal" Mo_2C matrix containing about 10% by volume of another phase distributed uniformly through it. A major problem was encountered in getting powders suitable for Verneuil-type crystal growth. Best results were obtained from compounds prepared by fusing together commercially available pure elements and crushing the lumps into a suitable particle size fraction. ***A. D. Kiffer.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 60-52, Apr. 1960, 24 pp. (TL507 Un3.18w Vis.)

13694 The Permeation of Hydrogen Through Hastelloy B. The flux of H gas through Hastelloy B, hot forged to 20% reduction, was determined as a function of membrane thickness, pressure differential, and temperature. ***D. W. Rudd, D. W. Vose, and J. B. Vetrano.*** *U. S. Atomic Energy Commission, NAA-SR-4898,* June 15, 1960, 13 pp. (UF767 Un3.1na Contin.)

13695 The Zirconium-Hydrogen System at High Hydrogen Contents. A pressure-composition-temperature study of this system in the temperature range 550-850 C was carried out from ZrH to ZrH_2. From the isotherms obtained in this investigation, the position of the boundary between the two-phase ($\beta + \delta$) region and the single phase δ region was more precisely defined (where β designates the H stabilized high temperature Zr phase, and δ the cubic hydride phase). ***G. G. Libowitz.*** *U. S. Atomic Energy Commission, NAA-SR-5015,* June 30, 1960, 21 pp. (UF767 Un3.1na Contin.)

13696* Electron-Optical Investigation of Oxide Layers on Nickel-Chromium and Nickel-Chromium-Iron Alloys. Composition of oxide layers on nickel-chromium-alloys with different Fe concentrations was studied. (*In German.*) Elektronenoptische Studien an Oxydschichten auf Nickel-Chrom- und Nickel-Chrom-Eisen-Legierungen. ***Irmtraud Pfeiffer.*** *Zeitschrift für Metallkunde,* v. 51, June 1960, p. 322-326.

13697* Preformed Nuclei on Conversions and Separations. Thermodynamical considerations show that preformed nuclei may exist above the equilibrium temperature in stable or metastable thermodynamical equilibrium. Slow growth occurs at lowering of temperature. Unlimited growth, however, occurs only below a definite temperature, called "martensite temperature", which is lower than the equilibrium temperature. (*In German.*) Präformierte Keime bei Umwandlungen und Ausscheidungen. ***Ulrich Dehlinger.*** *Zeitschrift für Metallkunde,* v. 51, June 1960, p. 353-356.

13698* Etch Pits in Deformed α-Iron. Using a suitable etching agent, the deformation structure of α-iron, deformed at different temperatures, was investigated by means of etch pits. The results are discussed. (*In German.*) Atzgruben in verformtem Alpha-Eisen. ***Guido Bassi.*** *Zeitschrift für Metallkunde,* v. 51, June 1960, p. 357-359.

13699* The Structure of the System Hafnium-Tungsten. Using arc-melted specimens the system Hf-W was investigated by X-rays, light microscope and determination of melting points. Characteristic are very narrow regions of solid solution at the system boundaries and an extremely hard intermetallic compound HfW_2, which forms peritectically. (*In German.*) Zum Aufbau des Systems Hafnium-Wolfram. ***Horst Braun and Erwin Rudy.*** *Zeitschrift für Metallkunde,* v. 51, June 1960, p. 360-363.

13700* Contribution to the Study of Size and Position of Precipitations at Large-Angle Grain Boundaries. Precipitation at normal grain boundaries was investigated in Al with 2 per cent Cu. (*In German.*) Beitrag zur Grösse und Lage von Ausscheidungen an Grosswinkelkorngrenzen. ***Wolfgang Bernhardt and Friedrich Erdmann-Jesnitzer.*** *Zeitschrift für Metallkunde,* v. 51, June 1960, p. 364-367.

METALS—POWDER

13701 Selected References on Making High-Temperature Alloys by Powder Metallurgy. ***Vincent D. Barth.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 47, Mar. 18, 1960, 6 pp. (TN799 B32.2d Contin.)

13702 Practical Aspects of Sintering Tungsten and Molybdenum. Gives manufacturing procedures for the preparation of W and Mo powders together with the method of pressing the powders in a mold and direct sintering the pressed bars at high temperatures. Describes the method of sintering, especially Mo in a hydrogen-water vapor atmosphere at about 1750 C, and the continuous pressing, partial sintering, and casting technique developed to meet demands for relatively large-size plate and sheet. ***D. J. Jones.*** *Journal of the Less-Common Metals,* v. 2, nos. 2-4, Apr.-Aug. 1960, p. 76-85.

13703 On the Influence of Small Additions of Nonmetals and Metals on the Sintering, Working and the Mechanical Properties of Tungsten. The influence of 0.01-1.0 wt.% of various elements on the sintering behavior, the workability, and the mechanical properties of W was examined. Carbon, boron, tungsten boride (W_2B), tungsten silicide (WSi_2), Al, Be, Ti, Zr, Hf, Th, V, and Cr were used as additives. Changes in the as-sintered density and hardness, workability by hot-rolling, transverse rupture strength and ductility (deflection on transverse bending) of worked alloys were determined and related to the concentration of alloying elements. ***H. Braun and K. Sedlatschek.*** *Journal of the Less-Common Metals,* v. 2, nos. 2-4, Apr.-Aug. 1960, p. 277-291.

13704 Vacuum Sintering. Discusses advantages, pumping equipment, furnaces, vacuum gages, and applications. ***F. G. Cox.*** *Metal Industry,* v. 97, Sept. 9, 1960, p. 207-209.

13705* Ductility Is a Feature of These Sinterings. Composite sintered materials which rival their wrought primary constituent in ductility have lately become available through the Sinterwrought process, an advanced powder metallurgy technique. Two of the products of this technique, aluminum/boron and stainless steel/boron composites, give every indication of overcoming the brittleness problem. *Metalworking Production,* v. 104, no. 36, Sept. 7, 1960, p. 70-71.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

13706* Electric Analysts in Our Metal Plants. Three new techniques for metallurgical analysis in process plants are described: the Cominco's process polarograph, a polarograph to measure dissolved air and an oscillometer for measuring the UO_2 content in solid samples. *Canadian Chemical Processing,* v. 44, Aug. 1960, p. 66 + 3 pages.

13707* Radiation Techniques for Process Measurements. Industrial Applications. Penetrating radiation can give valuable information concerning process conditions that are not available by other methods. Tells how to make various measurements and provides the details to solve typical problems. ***Alfred H. McKinney.*** *Chemical Engineering Progress,* v. 56, Sept. 1960, p. 37-48.

13708 A Radiochemical Investigation of the Combustion Method for the Determination of Sulphur in Cast Iron. The combustion method for the determination of S in cast iron was examined, using S^{35} as a tracer. Also investigated the reasons for nonstoichiometry and examined the distribution of S in the apparatus. ***R. C. Ronney and F. Scott.*** *Iron and Steel Institute, Journal,* v. 195, pt. 4, Aug. 1960, p. 417-421.

13709* Bore-Sighted Optical Inspection. The new, all-optical method yielded the necessary precision. In fact, it exceeded all requirements for aligning the center of scan of the microwave with the physical movements—roll, pitch, and yaw—of the gyro-antenna assembly. ***Arthur J. Conley.*** *Missile Design & Development,* v. 6, July 1960, p. 24-25.

13710 Statistic Methods in Material Testing. Some methods used in determining characteristic average variance values are described and the normal distribution of the control cards and the dependency problems between two series are studied. Planning methods for series of observations and test are considered. (*In German.*) Statistische Methoden in der Materialprüfung. ***A. Linder.*** *Schweizer Archiv für angewandte Wissenschaft und Technik,* v. 26, July 1960, p. 257-268.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

13711* Elastic Scattering of Protons by Means of Ne^{20} Nuclei. Using the results of phase analysis and certain formulas, the relationship between the polarization of protons, scattered at an angle of 90°, and the energy was calculated. The calculation was carried out in the interval of energies of protons of 1÷ 1.8 MeV. With high energies, one must calculate the effects of the resonances 1.96 and 2.15 MeV. The polarization of protons varies relatively evenly with the energy and reaches 70%. (*In Russian.*) Uprogoe rasseianie protonov iadrami Ne^{20}. ***A. K. Val'ter, A. S. Deĭneko, P. V. Sorokin, and A. Ia. Taranov.***

Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia, v. 24, no. 7, July 1960, p. 884-886.

13712* Method for the Identification of Charged Particles From Reactions With Rapid Neutrons. A method is suggested permitting a safe identification of the nature of charged particles within a wide interval of energies. In case a full section in reactions of the (n,p), (n,d) and (n,α) type is desired, thick targets can be used, so that reactions occurring with low probabilities can be investigated. A similar method can be used in studying the reactions produced by charged particles. (*In Russian.*) Metod identifikatsii zariazhennykh chastits iz reaktsiĭ s bystrymi neĭtronami. ***G. E. Veliukhov, A. N. Prokof'ev, and S. V. Starodubtsev.*** *Akademiia Nauk Uzbekskoi SSR, Izvestiia, Seriia Fiziko-Matematecheskikh Nauk*, 1960, no. 3, p. 24-31.

13713* Thermal Stresses and Their Significance in Nuclear Fuel Elements. Presents and discusses the concept of effect of temperature and temperature gradients in developing thermal stresses and strains. Equations for the general case are developed and applied to the specific case of the circular cylinder (pipe). Pictures and compares temperature and thermal stress distributions for four different potential nuclear fuel elements. Some conclusions of practical significance are drawn from this comparison. ***C. O. Smith.*** *American Society of Naval Engineers, Journal*, v. 72, no. 3, Aug. 1960, p. 393-400.

13714 Half-Life of Iridium 192. Using a null method, an ionization chamber and vibrating reed electrometer were employed to compare the γ-ray activity of an ^{192}Ir source with that of a reference ^{226}Ra source over a period of 209 days. An analysis of the results by the method of least squares indicates a half-life of ^{192}Ir of 74.17 ± 0.07 days. ***J. W. Allison.*** *British Journal of Applied Physics*, v. 11, July 1960, p. 302-304.

13715* Structural Problems in Reactor Engineering. Describes a few of the problems which occur in designing reactors of the gas-cooled graphite-moderated type. ***R. K. Livesley.*** *Chemical & Process Engineering*, v. 41, Aug. 1960, p. 353 + 4 pages.

13716* A Thermal Method of Preparing Sr-90 Sources. On the basis of a physicochemical study of different systems containing Sr-90, a thermal method was developed to prepare sources of ionizing radiation varying in form and intensity. These correspond to basic industrial needs, that is hermetic sources having heat-resistant and nonfreezing properties and high mechanical strength, simple to prepare and dependable and safe in their use. The types of sources developed served as a basis for the creation of typical equipment and systems concerning the automatic control and regulation of a number of production processes. (*In Russian.*) Osnovy termicheskogo metoda prigotovleniia beta-istochnikov s plavlennymi nositeliami, vkliuchiushchimi strontsiĭ-90. ***N. I. Bogdanov, K. P. Zakharova, P. V. Zimakov, and V. V. Kulichenko.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 20 pp. (QC770 C76pr)

13717* Elementary Particles. The history of science is the history of search for unifying concepts. The last 50 years of physics were mainly occupied with the search for, and identification of, the "ultimate" constituents of matter and energy, and with the development of concepts needed to understand their mutual interactions. Attempts an outline of this development. ***Abdus Salam.*** *Contemporary Physics*, v. 1, no. 5, June 1960, p. 337-354.

13718* Some Problems Concerning the Theory of Emission in the Case of Motion Beyond the Light Velocity in a Medium. Studies the properties of emission and the quantum theory and absorption in the case described, the emission reaction in the motion of a charge in a medium, the Cherenkov emission and absorption of waves in an isotropic and magnetically active plasma or in the case of dipole moments in a continuous medium and in the case of motion in channels and slits. (*In German.*) Einige Fragen der Strahlungstheorie bei Bewegung mit Überlichtgeschwindigkeit in einem Medium. ***V. L. Ginzburg.*** *Fortschritte der Physik*, v. 8, nos. 5-6, 1960, p. 295-326.

13719* Interactions of K^--Mesons at Rest in Nuclear Emulsions. V. The Multi-Nucleon Capture Mode. From a complete study of about 1100 K^--absorptions at rest in nuclear emulsions, it was determined that the multinucleon capture mode forms 37% ± 5%. The energy spectra of the Σ-hyperons were measured and calculated and a separation between Σ-hyperons resulting from single nucleon and multinucleon K^--captures was performed. Some evidence to the fact that multinucleon captures take place mostly in the heavy emulsion nuclei is presented. A method of determining all the multinucleon reaction rates is suggested and applied to our own data. This method makes use of the number and spectra of fast protons emitted from the K^--capture stars obtained in the present work. The results are compared with the predictions of a model recently proposed. ***M. Nikolic, Y. Eisenberg, W. Koch, M. Schneeberger, and H. Winzeler.*** *Helvetica Physica Acta*, v. 33, no. 3, 1960, p. 221-236.

13720* Interactions of K^--Mesons at Rest in Nuclear Emulsions. VI. The Single Nucleon Capture Mode. From an analysis of the pion producing events in K^--captures at rest in nuclear emulsions, the features of the single nucleon K^--capture mode were studied. Using the pion and Σ-hyperon emission probabilities obtained in the present experiment, and assuming charge independence, all the single nucleon ($1N$) reaction rates could be determined. Comparing our data to other K^--absorption experiments, the energy dependence of the $1N$ matrix elements becomes evident. It is estimated that 63% ± 5% of K^--captures lead to a $1N$ reaction and the rest give rise to multi-nucleon reactions. A study of electrons associated with the K^--capture stars indicates that a large fraction of the $1N$ captures takes place in the light emulsion nuclei and that most of the multi-nucleon captures take place in the heavy nuclei. Also shows that the Σ (or π) charge exchange scattering is small, in contrast to a large Σ-interaction ($\Sigma \rightarrow \Lambda$) cross section. ***W. Koch, Y. Eisenberg, M. Nikolic, M. Schneeberger, and H. Winzeler.*** *Helvetica Physica Acta*, v. 33, no. 3, 1960, p. 237-254.

13721* IRE Standards on Nuclear Techniques: Definitions for the Scintillation Counter Field, 1960. *I.R.E. Proceedings*, v. 48, Aug. 1960, p. 1449-1453.

13722 International Conference on Nuclear Physics, Proceedings. Low Energy Nuclear Interactions and Nuclear Structure. Held in Paris, France, July 7-12, 1958. ***P. Gugenberger.*** 950 pp. 1959. Crosby Lockwood & Son, Ltd., London. (QC770 In8pr)

13723* A Cooling Problem of Pebble-Bed Nuclear Reactors. The fundamental equations for the steady-state flow of a gas through a porous medium with prescribed heat source are derived. Application of these equations enable the pressure drop and the flow distribution of a gaseous coolant through a pebble-bed type nuclear reactor to be calculated. Gives one exact solution. The maximum gas temperature is found to be very much higher than the mixed mean value. ***L. S. Dzung.*** *International Journal of Heat and Mass Transfer*, v. 1, nos. 2-3, Aug. 1960, p. 236-241.

13724 On the Nuclear Resonance Fluorescence. Describes determinations of mean lives and nuclear level widths; supplies theoretical interpretation of the more important results. Experimental results performed with nuclear resonance fluorescence methods are compared with those obtained with other techniques (electronics, Doppler broadening, etc.) showing generally a good agreement. Appendix describes the application of nuclear resonance fluorescence to the study of weak interactions and to tests on general relativity theory. (*In Italian.*) Sulla fluorescenza di risonanza nucleare. ***D. Prosperi, M. C. Ramorino, and S. Sciuti.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNC-29*, Mar. 1960, 130 pp. (QC770 It1.2c Contin.)

13725 Scintillation Counters. Outlines the main parameters characterizing a scintillation counter. Discusses problems involving light collection from thin scintillators and light-pipes design. Describes the principal theoretical results about P. M. operation under pulse conditions and the results of a series of measurements designed to determine the work condition in which to have the best signal/noise ratio in RCA 6810A and RCA 6342 photomultipliers. ***A. S. Figuera and A. Serra.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNC-34*, 72 pp. (QC770 It1.2c Contin.)

13726* Pneumatic Irradiation System for the Measurement of Thermal Neutron Flux in a Pile. Describes an apparatus for making absolute measurement of the thermal neutron flux in the core of the EL3 reactor at Saclay by means of activation detectors. The apparatus consists of a pneumatic transfer system provided with solenoid valves whose sequence of operation is electronically controlled according to a predetermined program. A timing device measures the irradiation time (at the location of the measurement) and transit times (in and out of the reactor core) of the detector and its support. (*In French.*) Dispositif pneumatique d'irradiations pour la mesure des flux de neutrons thermiques dans une pile. ***P. Mulot, R. Poussot, and A. P. Schmitt.*** *Journal de Physique et le Radium* (Suppl.), v. 21, no. 7, July 1960, p. 79A-86A.

13727 Phase Oscillations in High Current Synchrotrons. The theory of phase oscillations in the synchrotron, first given by Bohm and Foldy, is extended to cover the case where the amplitude of the accelerating voltage is not constant and where the accelerated bunch is itself sufficiently large to produce an appreciable part of the accelerating voltage. It is found that the phase oscillation is more stable when the driving frequency is less than the natural frequency of the accelerating electrode system, and that the plate characteristic of the driving amplifier has a negligible effect on the phase stability. ***Irvin G. Henry.*** *Journal of Applied Physics*, v. 31, Aug. 1960, p. 1338-1342.

13728* The Agesta Nuclear Power/Heat Project—Sweden's First Industrial Reactor. Sweden's first industrial reactor installation to come into operation will be the Agesta nuclear station situated a few kilometers south of Stockholm. Due to reach criticality during 1962, the reactor will have an initial output of 65 MW(t). Part of this will be used to operate a 10 MW back pressure turbine and 55 MW will be delivered to a district heating scheme serving over 10,000 homes in a Stockholm suburb. *Nuclear Energy*, Aug. 1960, p. 358-360.

13729* The TURRET Reactor Project. Los Alamos Scientific Laboratory of the University of California has recently designed and put into development a nuclear reactor, called "Turret", involving such revolutionary concepts as "unclad" fuel elements and a revolving core permitting refuelling under power. The construction of the novel type reactor will begin later this year and the reactor will go into operation in the spring of 1962. *Nuclear Energy*, Aug. 1960, p. 361-362.

13730* Fields Excited by Beam Currents in Circular Accelerators. Gives formulas for the electric and magnetic fields in a circular accelerator of arbitrary cross section, excited by a nonscalloping beam of particles and considers both steady-state and step-function transients. ***J. Van Bladel.*** *Nuclear Instruments and Methods*, v. 8, July 1960, p. 1-10.

13731* Neutron and Proton Densities in Nuclei and the Semi-Empirical Mass Formula. The semi-empirical statistical method due to Wilets, with the use of trial nucleon densities, has been used to investigate the nucleon density distributions and their relation with the semi-empirical mass formula. ***A. R. Bodmer.*** *Nuclear Physics*, v. 17, no. 3, July 1960, p. 388-420.

13732* The Spray Cooled Reactor. Preliminary design studies confirm that this system combines many of the advantages of boiling and steam cooling. ***J. G. Collier and P. M. C. Lacey.*** *Nuclear Power*, v. 5, Aug. 1960, p. 68-73.

13733* Control of Power Reactors. II. Considers over-all control and the performance required of an automatic control system. ***R. H. Campbell.*** *Nuclear Power*, v. 5, Aug. 1960, p. 74-77.

13734* Gas Ionization Detectors. A survey of the four main types of gas ionization detectors, namely: Geiger-Muller counters, proportional counters, mean current ionization chambers, and pulse ionization chambers. ***W. R. Loosemore.*** *Nuclear Power*, v. 5, Aug. 1960, p. 84-89.

13735 Critical Measurements on Near-Homogeneous BeO-Moderated, Enriched-Uranium Fueled Systems. Describes a series of critical measurements on unreflected systems, fueled by thin enriched U (93.2%) foils. Fuel density is varied by use of different foil thicknesses and spacings between foils. Five fuel densities were used which correspond to atomic BeO/U^{235} ratios from 246 to 7660. For three of these ratios, the fuel foil thickness was varied to find effects of self-shielding and flux depression on the critical dimensions. ***Fred A. Kloverstrom, Richard M. K. Deck, and Arnold J. Reyenga.*** *Nuclear Science and Engineering*, v. 8, Sept. 1960, p. 221-225.

13736 Effect of Delayed Neutrons on Nonlinear Reactor Stability. The effect of delayed neutron precursors on the stability of nuclear reactors described by nonlinear equations is investigated. Shows by means of Liapunov's second method that a sufficient condition of stability is that the reactor be stable without delayed neutron precursors. An illustrative example is included. ***Elias P. Gyftopoulos and Jacques Devooght.*** *Nuclear Science and Engineering*, v. 8, Sept. 1960, p. 244-250.

13737 On the Applicability of the Transport Approximation to the Calculation of Reactivity. The validity of the transport approximation is checked for systems which cannot be treated by the diffusion approximation and deviations of the transport approximation from exact calculations are evaluated by means of a perturbation formula. Concludes that even for critical systems of dimensions of the order of the transport mean free path, the transport approximation yields good results. ***G. Rakavy.*** *Nuclear Science and Engineering*, v. 8, Sept. 1960, p. 251-253.

13738 Control Rod Theory for Asymmetrical Arrays and Reflected Cores. Criticality conditions suitable for hand calculations are derived for reactor control rod configurations of practical interest. Two-group diffusion theory is applied to arrays of several control rods of different materials, sizes, shapes, radial, and angular location; reflected cores containing a symmetric ring of similar rods, with or without an axial rod. The reduction to elementary cases is demonstrated. ***Raymond L. Murray, William T. Price, and Samuel H. Birken.*** *Nuclear Science and Engineering*, v. 8, Sept. 1960, p. 254-259.

13739 Thermal Neutron Flux Distributions in Metal-Hydrogenous Shields. A calculational technique is presented for predicting thermal neutron fluxes in the primary shields of reactor systems which eliminates reliance on mock-up experimental data. A multigroup P_1 approach is employed with the spatial dependence of the neutron attenuation adjusted through use of a point source attenuation kernel for a homogeneous hydrogenous medium. Comparison of calculation with experiment is presented. ***D. C. Anderson and K. Shure.*** *Nuclear Science and Engineering*, v. 8, Sept. 1960, p. 260-269.

13740 Standard Boron Solutions for Neutron Absorption Measurements. A procedure is described for preparing deuterated boric acid solutions for use in the absolute determination of the cross section for absorption of thermal neutrons and for reference standards. The suitability of these solutions as standards is discussed in terms of the purity of the reagents, the reproducibility of preparation, and the composition of the boric oxide used in the preparation. ***S. Wexler.*** *Nuclear Science and Engineering*, v. 8, Sept. 1960, p. 270-273.

13741 Nuclear Interactions of 5.7 BeV Protons in Photographic Emulsion. Tracks produced by 5.7 bev protons in nuclear emulsions were followed till they interacted with emulsion nuclei, and a mean free path of 35.6 ± 2.4 cm was obtained. About 24% of the shower tracks were found to be protons, all of which emerged at angles less than 20° with the direction of the primary. The mean multiplicity of pion production was found to be 2.6 ± 0.3, the coefficient of inelasticity of 0.49 ± 0.07, and the transverse momentum of pions 220 ± 30 mev/c. ***V. Y. Rajopadhye.*** *Philosophical Magazine*, v. 5, ser. 8, June 1960, p. 537-551.

13742 Hyperfine Structure of the 6 $^3P_2$ State of $_{80}Hg^{199}$ and $_{80}Hg^{201}$. Properties of Metastable States of Mercury. The hyperfine structures were measured by means of the atomic-beam magnetic resonance technique. The present experiment is the first one for which the electron bombardment method has been used in the production of a narrowly collimated beam of metastable atoms. The beam was detected by surface ejection of electrons from an alkali metal surface. The values of the quadrupole and octupole moments of Hg^{201} are, without polarization corrections, $Q = 0.50(4) \times 10^{-24}$ cm^2 and $\Omega = 0.13$ nuclear magneton barn. The hyperfine structure anomaly for the two isotopes due to the s electron alone is $\Delta(s_{1/2} = -0.1728(12)\%$ in disagreement with the predictions of the

single-particle model. A new technique for obtaining excitation functions is discussed. ***Mark N. McDermott and William L. Lichten.*** *Physical Review*, v. 119, 2nd ser., no. 1, July 1, 1960, p. 134-143.

13743 Decay of Ga^{66} and Cu^{66}. The 9.5-hour decay of Ga^{66} and the 5.1-minute decay of Cu^{66} were studied by a variety of techniques including gamma-ray spectroscopy, internal conversion measurements, and angular correlation studies. All but one of the 18 gamma rays observed have been ordered into a structure of 11 levels and the spins and parities of all but one of these levels have been determined. Shows that Ga^{66} has spin zero and even parity and that its 4.166-Mev β spectrum is a pure Fermi transition. The energy of the internal conversion line of the 4.300 ± 0.005 Mev transition was measured with great care and this line may be useful for spectrometer calibration. The second excited state of Zn^{66}, at 1.875 Mev, has 2+ spin and parity. The stopover transition from this state contains at least 10% *M*1 radiation: the stopover to crossover ratio is greater than 100 to 1. ***Arthur Schwarzschild and Lee Grodzins.*** *Physical Review*, v. 119, 2nd ser., no. 1, July 1, 1960, p. 276-286.

13744 Depolarization and Time Reversal in *p-p* Scattering at 142 Mev. The depolarization in proton-proton scattering at 142 Mev was measured at angles from 6° to 40° in the laboratory system. Measurements were made by scattering a 67% polarized proton beam first off a liquid H target, then off a C (or Li) analyzer. The scattered protons were detected by plastic scintillation counters, and the asymmetries from the last scattering were measured at each H scattering angle. The angular dependence of depolarization determined was similar to that measured at 315 Mev by other workers. The data disagree with other measurements at 143 Mev. By measuring on both sides of the beam, the polarization in scattering is determined and compared with asymmetry in scattering from a polarized beam. Their equality confirms time reversal invariance in the proton-proton interaction. ***C. F. Hwang, T. R. Ophel, E. H. Thorndike, and Richard Wilson.*** *Physical Review*, v. 119, 2nd ser., no. 1, July 1, 1960, p. 352-361.

13745 Decay of μ^- Mesons in the *K* Shell of Light Nuclei. The decay electron spectrum is calculated accurately up to the first power in Z, both for point and extended nuclei. The decay rate is evaluated accurately up to the second power for point nuclei. Results for the spectrum show the Doppler smearing of its upper end as obtained previously, and demonstrate the small effect of the nuclear extension. The decay rate is obtained as a monotonically decreasing function of Z; author cannot explain recent experiments which show a maximum of the decay rate around Z~26. Decay rate in second order decreases much more slowly with Z than what would be obtained from a phase space consideration alone. ***H. Überall.*** *Physical Review*, v. 119, 2nd ser., no. 1, July 1, 1960, p. 365-376.

13746 Studies of Decay Schemes in the Osmium-Iridium Region. II. Decay of 12-Day Ir^{190}. ***W. R. Kane, G. T. Emery, G. Scharff-Goldhaber, and M. McKeown.*** *Physical Review*, v. 119, 2nd ser., no. 6, Sept. 15, 1960, p. 1953-1969.

13747 9.0-Mev Gamma-Emitting Level in C^{13}. An energy level in C^{13} at 9.0±0.1 Mev was detected by means of (p,γ,γ) coincidence measurements on the $B^{10}(He^3,p)C^{13}$ reaction at $E_{He^3} = 2.2$ Mev. This state decays by a γ-γ cascade through the 4.43-Mev first excited state. An upper limit of 5% is placed on the ground-state γ-ray transition. ***D. E. Alburger and R. E. Pixley.*** *Physical Review*, v. 119, 2nd ser., no. 6, Sept. 15, 1960, p. 1970-1974.

13748* Power and Heat From Reactors in Sweden. Although almost totally lacking in fossil fuel deposits, Sweden has extensive shale deposits in its central part which contain U. A small extraction plant has been in operation since 1953, but larger plants capable of meeting Swedish atomic energy needs are expected to be in operation by 1964. *Power Engineering*, v. 64, Aug. 1960, p. 56-59.

13749 Progress in Elementary Particle and Cosmic Ray Physics. Discusses: weak interactions; phenomenology of the nucleon-nucleon interaction; theory of antinucleons; observations on cosmic ray "jet" interactions in nuclear emulsions; and absorption and decay of negative muons. ***J. G. Wilson and S. A. Wouthuysen, editors.*** v. V. 461 pp. 1960. Interscience Publishers, New York. (QC485 W69p)

13750 Progress in Nuclear Energy. Ser. I. Physics and Mathematics. Provides reviews of progress in the basic experimental and theoretical aspects of reactor physics, ranging from measurements of the fundamental neutron cross sections to the detailed theory of the behavior of multiplying assemblies. Concerned with developments since the 1955 Geneva Conference. ***D. J. Hughes, J. E. Sanders, and J. Horowitz, editors.*** v. II. 375 pp. 1958. Pergamon Press, New York. (QC776 P94n)

13751 Progress in Nuclear Energy. Ser. I. Physics and Mathematics. Selection of the papers presented at the Second U.N. Conference on the Peaceful Uses of Atomic Energy held in Geneva during September, 1958. Papers included give a balanced view of the work of the conference in connection with the fundamental neutron interactions of interest to the reactor physicist. ***Donald J. Hughes, J. E. Sanders, and J. Horowitz, editors.*** v. III. 396 pp. 1959. Pergamon Press, New York. (QC776 P94n)

13752 Progress in Nuclear Energy. Ser. VIII. The Economics of Nuclear Power Including Administration and Law. Proceedings of the Second International Conference on the Peaceful Uses of Atomic Energy held at Geneva. Emphasis is placed on meeting world energy requirements both in underdeveloped countries and in countries with diminishing supplies of conventional material. Discusses mining methods, production costs, recovery from ores, and subsidiary applications. Includes reports on the Atomic Energy Programs in Canada, France, India, Italy, Japan, Poland, U.S.A., and the U.S.S.R. ***I. R. Maxwell, P. W. Mummery, and Philip Sporn, editors.*** v. II. 1959. Pergamon Press, New York. (QC776 P94n)

13753 Progress in Nuclear Energy. Ser. XII. Health Physics. Selection of papers contributed to the Second International Conference on the Peaceful Uses of Atomic Energy, Geneva, concerned with the various aspects of radiological health and safety in atomic energy. Since the range of topics covered under the heading "Health Physics" is so wide today, it was considered desirable to include many papers on the important outlying branches of the subject, e.g., food chains and meteorology. The student of the subject will be introduced to these important aspects as well as the more obvious radiological physics subjects relevant to health and safety. ***W. G. Marley and K. Z. Morgan, editors.*** v. I. 602 pp. 1959. Pergamon Press, New York. (QC776 P94n)

13754* Pion-Nucleon Interaction, Anomalous Magnetic Moment of Nucleon and Composite Model for Pion. The effective pion-nucleon interaction and the anomalous magnetic moment of the nucleon are calculated on the basis of the composite model for the pion in which the fundamental interaction is assumed to be an adequate linear combination of scalar, tensor and pseudoscalar, of vector and pseudovector Fermi type couplings. The results are qualitatively in agreement with experiment. ***Chiaki Ihara.*** *Progress of Theoretical Physics*, v. 23, no. 6, June 1960, p. 1035-1054.

13755* Reactor Fuel Processing. A review of recent developments. *Reactor Fuel Processing*, v. 3, no. 3, July 1960, 49 pp.

13756 Realization, Preservation and Comparison of the Unit of Dose for Roentgen and Gamma-Radiation With Quantum Energies Between 3 and 400 Kev. A manual for the dosimetry of standards. ***B. Rajewsky, et al.*** *U. S. Atomic Energy Commission, AEC-tr-3840*, Apr. 1960, 144 pp. (UF767 Un3.1ae Contin.)

13757 Thermal Cycling of EBR-I, Mark III Fuel. Describes the EBR-I, Mark III fuel fabrication process; an exposition of the thermal cycling tests on fuel samples by Reactor Engineering and the Idaho Divisions. All samples tested were received from the ANL Metallurgy Division and fabricated in the Lemont shop. Results of these thermal cycling tests, coupled with observations made by the Metallurgy Division on the irradiation behavior of the fuel, resulted in the selection of the optimum heat treatment subsequently used in the fabrication of the Mark III core loading. ***G. K. Whitman and E. S. Sowa.*** *U. S. Atomic Energy Commission, ANL-6028*, Apr. 1960, 25 pp. (UF767 Un3.1an Contin.)

13758 Two-Dimensional Two-Group Calculation of the Argonaut One Slab Loading. An attempt to set forth in systematic form the two-energy group physics calculations for the Argonaut one-slab configuration. States all assumptions and

gives full calculational details so that the reader may easily follow the procedure used. Gives complete point-by-point flux values from the PDQ programming of the problem on the IBM 704 computer. Includes comparison of theoretical and experimental results. ***Don P. Moon.*** *U. S. Atomic Energy Commission, ANL-6154,* Apr. 1960, 92 pp. (UF767 Un3.1an Contin.)

13759 Thorium Uranium Physics Experiments. Study of uniform lattice cores moderated with light water. TUPE cores contain thorium oxide-uranium oxide pins clad with Al and have metal-to-water volume ratios, M/W, ranging from 0.3 to 1.0. ***N. L. Snidow, et al.*** *U. S. Atomic Energy Commission, BAW-1191,* May 1960, 174 pp. (UF767 Un3.1ba Contin.)

13760 Development of a Fuel-Element Leak-Detection System Based on the Principle of Isotopic Exchange. The selective removal of halide fission products from an aqueous solution by exchange with the halide in solid silver halide was studied as the basis for a fuel-element leak detector. The retention of fission-product halides on a silver halide column was investigated as a function of coolant flow rate, halide anion, and column size. Fission-product decontamination factors and predicted operating lifetimes were obtained for a number of reactor operating conditions. A sensitive, rapid leak detector for a water-cooled reactor could be constructed from a silver bromide or iodide column monitored by a neutron detector to detect delayed neutrons from the halide fission products. ***James E. Howes, Jr., Thomas S. Elleman, and Duane N. Sunderman.*** *U. S. Atomic Energy Commission, BMI-1432,* Aug. 1, 1960, 18 pp.

13761 Irradiation Effects on Massive Uranium Monocarbide. Results of examinations of UC compounds having nominal compositions of U-4.6, -4.8, and -5.0 w/o C are encouraging after irradiation to burnups of from 400 to 15,000 MWD/T of U. Density changes were small. Cracking occurred in all specimens; however, it can probably be attributed to thermal stresses and to oxidation, after decapsulation, of NaK entrapped in microcracks. Metallographic examination shows that the UC_2 phase disappears at high temperature and high burnup. ***Alan W. Hare and Frank A. Rough.*** *U. S. Atomic Energy Commisison, BMI-1452,* July 21, 1960, 28 pp. (UF767 U3b Contin.)

13762 Apparatus for the Study of Fission-Gas Release From Fuels During Postirradiation Heating at Temperatures Up to 1600 C. Xenon and krypton fission gases escaping from a small specimen during heating at constant temperature are measured using a continuous radioactivity monitor and charcoal adsorption traps. Helium carrier gas is purified by activated alumina, Cu, and Zr traps, and the O and moisture contents of the gas are monitored continuously. The operating procedure and data are presented for a typical heating experiment. ***Russell H. Barnes and Duane N. Sunderman.*** *U. S. Atomic Energy Commission, BMI-1453,* July 22, 1960, 12 pp. (UF767 U3b Contin.)

13763 Precipitation of Radioruthenium. Radioruthenium sulfides were quantitatively precipitated from solutions containing any one of five reagents. Describes a procedure for the specific determination of Ru in an acid solution of mixed fission products and induced activities. ***Frank E. Butler.*** *U. S. Atomic Energy Commission, DP-494,* June 1960, 11 pp. (UF767 Un3.1dp Contin.)

13764 Oxygen Diffusion and Reaction During Gamma Irradiation of Polyethylene. Theory based on diffusion kinetics which relates the total oxidation to total dose, dose rate, and sample thickness. It is possible to predict the distribution of oxidation in thick samples of the polymer. The theory is compared with experimental observations. ***R. C. Giberson.*** *U. S. Atomic Energy Commission, HW-64305,* July 1, 1960, 42 pp. (UF767 Un3.1hw Contin.)

13765 ETR Cycle 18 Thermal and Fast Neutron Flux Measurements. The thermal and fast neutron fluxes in selected positions of the ETR were measured for Cycle 18. Shows a flux map of the ETR tank and traverses for all positions monitored. ***L. D. Weber and C. H. Hogg.*** *U. S. Atomic Energy Commission, IDO-16563,* June 20, 1960, 49 pp. (UF767 Un3.1id Contin.)

13766 Army Gas-Cooled Reactor Systems Program. The ML-1 Design Report. The ML-1 is a high-temperature, gas-cooled, water-moderated reactor coupled to compact power conversion equipment. This closed-cycle gas-turbine power plant will have an electrical power-generating capacity of 300-500 kw. The design is reported in detail. *U. S. Atomic Energy Commission, IDO-28550,* May 16, 1960, 141 pp. + appendix. (UF767 Un3.1id Contin.)

13767 Experimental and Analytical Studies of Reflector Control for the Advanced Engineering Test Reactor. A. Experimental Studies With the Reflector Control System Model. B. Analytical Studies of Reflector Control. A. ***W. S. Delicate, M. J. Kornfeld, and A. M. Larson.*** B. ***P. C. Bertelson and T. L. Francis.*** *U. S. Atomic Energy Commission, INTERNUC-47,* Oct. 21, 1959, 256 pp. (UF767 Un3.1in Contin.)

13768 Some Value Functions for Multicomponent Isotope Separation - Application to a Unit Cost Scale for Uranium-235, 236, 238 Mixtures. Presents a theoretical study of multicomponent isotope separation cascades. A theory is developed which leads to the multicomponent analogue of the two component "ideal cascade". The theory is applied specifically to the derivation of a multicomponent cost formula which could be used to price U containing U-236. The multicomponent matched abundance ratio cascade does not minimize total cascade flow as does the two-component ideal cascade. It is found, however, that for uranium isotope separation the total flow in the matched U-235/U-238 abundance ratio cascade exceeds the minimum by an insignificant fraction for a wide range of U-236 concentrations. ***A. de la Garza, G. A. Garrett, and J. E. Murphy.*** *U. S. Atomic Energy Commission, K-1455,* July 19, 1960, 75 pp. (UF767 Un31k Contin.)

13769 Quarterly Status Report on LAMPRE Program for Period Ending May 20, 1960. ***Samuel Glasstone, editor.*** *U. S. Atomic Energy Commission, LAMS-2438,* June 1960, 63 pp. (UF767 Un3.1La Contin.)

13770 Quarterly Status Report of the LASL Controlled Thermonuclear Research Program for Period Ending May 20, 1960. ***Samuel Glasstone, editor.*** *U. S. Atomic Energy Commission, LAMS-2444,* July 1960, 59 pp. (UF767 Un3.1La Contin.)

13771 PM-1 Nuclear Power Plant Program. 4th Quarterly Progress Report. ***E. H. Smith.*** *U. S. Atomic Energy Commission, MND-M-1815,* Apr. 5, 1960, sections individually paged. (UF767 Un3.1mn Contin.)

13772 Homogeneous Reactor Program. Quarterly Progress Report for Period Ending April 30, 1960. *U. S. Atomic Energy Commission, ORNL-2947,* Aug. 9, 1960, 133 pp. (UF767 U3o Contin.)

13773 Pseudoscalar Interaction in Nuclear Beta Decay. ***Chander P. Bhalla.*** *U. S. Atomic Energy Commission, ORNL-2950,* July 11, 1960, 179 pp. (UF767 U3o Contin.)

13774 Progress in Carbide Fuels. Discusses uranium and plutonium carbide development at Argonne, uranium carbide development program at Atomics International, research on uranium carbide and carbide-type fuel materials at Battelle, experimental work on uranium carbide at the Carborundum Co., a preliminary report on uranium carbide research at Combustion Engineering, Inc., uranium carbide research at General Atomic, power-reactor research at Lawrence Radiation Laboratory, and other problems. *U. S. Atomic Energy Commission, TID-7589,* Apr. 20, 1960, 90 pp. (UF767 Un3ti Contin.)

13775 Civilian Power Reactor Program. III. Status Report on Aqueous Homogeneous Reactors as of 1959. Discusses program objectives and history, description of power-breeder station, work done, current program, design studies, problems and limitations. *U. S. Atomic Energy Commission, TID-8518(3),* 1960, 184 pp. (UF767 Un3ti Contin.)

13776 Civilian Power Reactor Program. III. Status Report on Organic-Cooled Power Reactors as of 1959. Discusses concept description, research and development program, experimental reactors, design studies. *U. S. Atomic Energy Commission, TID-8518(7),* 1960, 71 pp. (UF767 Un3ti Contin.)

13777 Possible Large-Scale Uses of Separated Fission Products. Gives the current status of possible large-scale uses of separated fission products. As used here, "large scale" means operational quantities in the range of megacuries, which exceeds present availability and market. ***William H. McVey.*** *U. S. Atomic Energy Commission, TID-8521,* Apr. 1960, 5 pp. (UF767 Un3ti Contin.)

13778 Fast Breeder Reactor Program. *U. S. Atomic Energy Commission, TID-8523,* Jan. 1960, 12 pp. (UF767 Un3ti Contin.)

13779 Boiling Nuclear Superheater (Bonus) Power Station. Preliminary Design Study and Hazards Summary Report. v. 1. Reference Design. Describes reactor, reactor auxiliary systems, a power plant, electrical generation and distribution, station control, instrumentation, containment building, site development and structure. *U. S. Atomic Energy Commission, TID-8524,* June 1960, 238 pp. (UF767 Un3ti Contin.)

13780 Controlled Thermonuclear Research Quarterly Report. *U. S. Atomic Energy Commission, UCRL-9106,* Mar. 17, 1960, 122 pp. (UF767 U3u Contin.)

13781 A Study of Some Coherent Electromagnetic Effects in High-Current Particle Accelerators. Considers two coherent effects by which particles circulating in an accelerator may lose energy, and discusses the interaction of the beam with a radio-frequency cavity that provides the accelerating mechanism of the machine. ***Verl Kelvin Neil.*** *U. S. Atomic Energy Commission, UCRL-9124,* Apr. 26, 1960, 138 pp. (UF767 U3u Contin.)

13782 The Application of the Mandelstam Representation to Photoproduction of Pions From Nucleons. The Mandelstam representation is applied to the invariant amplitudes for photoproduction. By treating gage invariance as a subsidiary condition, it is shown that the fixed-momentum-transfer dispersion relations of Chew, Goldberger, Low, and Nambu (CGLN) are probably valid without subtractions for the (-) amplitudes while a three-pion resonance would perhaps require a subtraction in the (+) amplitudes. The two-pion resonance will certainly require a subtraction for the (O) amplitudes, but to a good approximation the contribution of the two-pion intermediate state is found to produce a simple additive correction to the CGLN (O) formula. ***James Stutsman Ball.*** *U. S. Atomic Energy Commission, UCRL-9172,* Apr. 11, 1960, 79 pp. (UF767 U3u Contin.)

13783 Some Nuclear and Electronic Ground-State Properties of Pa^{233}, Am^{241}, and 16-hr Am^{242}. The atomic-beam, magnetic-resonance method was used to study some properties of the nuclear ground-state and the low-lying electronic states of three radioactive actinide isotopes. ***Joseph Winocur.*** *U. S. Atomic Energy Commission, UCRL-9174,* Apr. 13, 1960, 128 pp. (UF767 U3u Contin.)

13784 A Further Study of Antiproton Interactions and the Annihilation Process. The annihilations of 2900 ± 120 $\bar{p}$ at an average momentum of 1050 Mev/c were analyzed in the 30-in. LRL propane bubble chamber. The $\bar{p}$ annihilation cross sections for H and C were found to be 51 ± 10 mb and 368 ± 60 mb, respectively. The $\bar{p}$ charge-exchange differential cross section peaks forward strongly. The K-meson multiplicity, $\langle N_{K\bar{K}} \rangle = 8(\pm 1)\%$ per star, is considerably higher than at lower antiproton energies. The primary pion multiplicity in stars with K mesons is 2.4 ± 0.5. The average pion multiplicity in stars with no strange particles is 5.0 ± 0.2 for both H and C. The width of the pion-multiplicity distribution function was found to be in agreement with that predicted by the Fermi statistical model with an increased interaction volume. In addition, interactions of about 853 antiprotons were analyzed in emulsions. ***Rein Silberberg.*** *U. S. Atomic Energy Commission, UCRL-9183,* Apr. 11, 1960, 76 pp. (UF767 U3u Contin.)

13785 Bevatron Operation and Development. XXIV. Study of particle interactions was continued. Bubble chambers, counting systems, and nuclear emulsions were used to investigate the interactions of π^-, μ^-, and K^+ mesons. Two primary experiments conducted during this period were made by groups visiting the laboratory. Nuclear emulsion stacks were exposed for ten outside groups—five exposures to a π^- beam and five to a K^+ beam. ***Walter D. Hartsough.*** *U. S. Atomic Energy Commission, UCRL-9220,* May 25, 1960, 13 pp. (UF767 U3u Contin.)

13786 Bevatron Operation and Development. XXV. Bubble chambers were used in the secondary beams of the Bevatron to investigate π^- interactions in H and K^- interactions in propane, and to measure the θ_1-θ_2 mass difference. Counter experiments were made to study the interactions of K^-, π^- and μ mesons. Three bombardments were made in the primary beam for the chemistry group. ***Walter D. Hartsough.*** *U. S. Atomic Energy Commission, UCRL-9221,* June 7, 1960, 10 pp. (UF767 U3u Contin.)

13787 Low-Energy Photopion Production From Pions and Neutral-Pion Decay. The Mandelstam representation is applied to the process $\gamma + \pi \rightarrow 2\pi$. Shows that a homogeneous integral equation may be obtained for the p-wave amplitude whose solution allows one arbitrary real multiplicative constant, which at present must be determined from experiment. By the use of crossing symmetry, a simple and tractable approximate solution of the integral equation is obtained. Higher partial waves may be calculated in terms of the p-wave. The order of magnitude of the new constant is estimated by considering the decay rate of the neutral pion, in which the amplitude for $\gamma + \pi \rightarrow 2\pi$ should play a prominent role. ***How-sen Wong.*** *U. S. Atomic Energy Commission, UCRL-9251,* June 2, 1960, 37 pp. (UF767 U3u Contin.)

13788 Bettis Technical Review. Reactor Technology. A collection of ten articles on reactor technology. *U. S. Atomic Energy Commission, WAPD-BT-18,* Apr. 1960, 134 pp. (UF767 Un3.1wb Contin.)

OPERATIONS RESEARCH

13789* The "Assistant-to" in Four Administrative Settings. The use of a personal assistant by the high-level executive has excited controversy among management consultants and well-known business executives. An earlier study of the assistant to the president of a business firm revealed why he is controversial and how his presence can affect communications and power relationships in the management hierarchy. The present study extends to the military establishment, federal government, and city management. ***Thomas L. Whisler.*** *Administrative Science Quarterly,* v. 5, no. 2, Sept. 1960, p. 181-216.

13790* Observations on the Dynamics of a Change to Electronic Data-Processing Equipment. Explains the effects of a change-over to electronic data-processing equipment in a light and power company. Treats the general problems of introducing this change, which extended over five years and affected more than 1600 employees in two organizational divisions. ***Floyd C. Mann and Lawrence K. Williams.*** *Administrative Science Quarterly,* v. 5, no. 2, Sept. 1960, p. 217-256.

13791* Two Approaches to Organizational Analysis: A Critique and a Suggestion. Criticizes the often-used goal model for measuring effectiveness. Suggests a system model and specifies its advantages over the goal model. The system model is theoretically more powerful and avoids certain value judgments. ***Amitai Etzioni.*** *Administrative Science Quarterly,* v. 5, no. 2, Sept. 1960, p. 257-278.

13792* PL(Production Logic): A New Concept in Complete Management Thinking. The combination of logical, production-oriented thinking and the application of production control theory can establish criteria permitting top corporate management decisions in other fields—marketing and finance, for example. ***Stanley Mantell.*** *Advanced Management,* v. 25, Aug. 1960, p. 6-11.

13793* Ideological Pitfalls in Contemporary Management Practices. Management's ideological preoccupation with the wage employee and his union can be dangerous at a time when payments to nonproduction workers are increasing rapidly. More concern with modern organization theory is suggested. ***Alfred L. Thimm.*** *Advanced Management,* v. 25, Aug. 1960, p. 13-15.

13794* Motivating the Boss. The Key to Executive Development. Lack of motivation or ambition does not usually inhibit management development; but lack of opportunity and top management interest may do so. ***Ralph L. Gillen and Herbert Hubben.*** *Business Horizons*, v. 3, no. 3, Fall 1960, p. 49-54.

13795 Personnel Problems Facing Firms in Southeast Asia. There are lessons in Southeast Asia for every business firm interested in under-developed economies. Ultimate success or failure in industrialization depends upon the extent to which the foreign society's manpower resources can be effectively utilized in a modern business setting. ***Daniel Wit.*** *Business Horizons*, v. 3, no. 3, Fall 1960, p. 77-83.

13796 Contributions to the Theory of Games. Papers demonstrate how the theory of games continues to be an object of vigorous and expanding research. Not only are outstanding problems solved but fresh problems are raised and the theory is extended in new directions. v. II. ***H. W. Kuhn and A. W. Tucker, editors.*** 395 pp. 1953; v. III. ***M. Dresher, A. W. Tucker, and P. Wolfe, editors.*** 435 pp. 1957; v. IV. ***A. W. Tucker and R. D. Luce, editors.*** 453 pp. 1959. Princeton University Press, Princeton, N. J. (QA273 K95c)

13797* Management's Role in Free Western Society. Our free-enterprise society has entrusted management with nothing less than the obligation to organize and to operate the productive resources of the whole economy. This has resulted in achievement of the greatest good for the greatest number. ***John S. Bugas.*** *Industrial Development*, v. 129, no. 10, Sept. 1960, p. 6 + 5 pages.

13798 If You Are Not Advancing, Take a Hard Look at Yourself. Many are unwilling to pay the high price of bigger executive jobs. Or, maybe you do have the "stuff" but are in the wrong company. Wives play a bigger part in executive success and failure than most realize. ***F. J. Gaudet.*** *Iron Age*, v. 186, no. 11, Sept. 15, 1960, p. 120-122.

13799* Monopologs: Management Decision Making Game Applied to Tool Room Management. The game is intended to focus attention on only a very limited area of an operational situation. The umpire of the game should be aware of the players' motivation. In the discussion which follows the game, he should point out the strengths and weaknesses of the policies employed. ***Forest M. Campbell and E. Robert Ashworth.*** *Journal of Industrial Engineering*, v. 11, no. 5, Sept.-Oct 1960, p. 372-377.

13800* The Reorganization Controversy. The soundest philosophy of reorganization is the perpetual or gradual approach. In a well managed business by the process of giving intelligent consideration to the problems of organization at all times, spasmodic and revolutionary changes are avoided. ***Howard Urow.*** *Journal of Industrial Engineering*, v. 11, no. 5, Sept.-Oct. 1960, p. 378-382.

13801* A Mathematical Model for Production Scheduling in the Aircraft Industry. The mathematical model can be used to generate a large number of schedules with different manpower and in-process inventory characteristics, and can be profitably used, especially during preliminary planning. It can act as a basis for optimizing schedules. ***Arjan Bhatia.*** *Journal of Industrial Engineering*, v. 11, no. 5, Sept.-Oct. 1960, p. 383-388.

13802* A Classification of Inventory Control Theory. Suggests one possible classification plan which unifies inventory control theory into a logical body of knowledge. ***Thomas L. Newberry.*** *Journal of Industrial Engineering*, v. 11, no. 5, Sept.-Oct. 1960, p. 391-397.

13803* Logistics Research and Management Science. Discusses the variety of subjects studied by the RAND Corporation in research done for the Air Force. Included are: demand prediction, inventory control, procurement and other decision rules, management-control systems, etc. These have made use of many traditional tools of analysis and management science. In addition, simulation techniques were found particularly useful in fitting together pieces of separate research into a systems context for feasibility and consistency tests. ***Murray A. Geisler.*** *Management Science*, v. 6, no. 4, July 1960, p. 444-453.

13804* Games Decisions and Industrial Organization. Presents a survey of the current relationship between the many different problem areas investigated by means of game theory and the study of industrial organization. ***M. Shubik.*** *Management Science*, v. 6, no. 4, July 1960, p. 455-474.

13805* Optimal Policies for a Multi-Echelon Inventory Problem. If an order is placed by installation one for stock from installation two, the length of time for delivery of this stock is determined not only by the natural lead time between these two sites, but also by the availability of stock at the second installation. Considers the problem of determining optimal purchasing quantities in a multi-installation model of this type. ***Andrew J. Clark and Herbert Scarf.*** *Management Science*, v. 6, no. 4, July 1960, p. 475-490.

13806* An Integrated Project for the Design and Appraisal of Mechanized Decision-Making Control Systems. This control system attempts to achieve a certain balance of a set of local goals. Describes the balance of these goals by a set of parameters and by varying these parameters, differing control systems can be applied to the plant and each will lead to certain levels of attainment of long-term goals. The problem of achieving the "required" balance of these is reduced to determining the "optimum" values of these parameters. The appropriate model is a simulation model of the plant operated by a digital computer. Since it is intended to apply this technique to a wide variety of plants, a general computer program was developed, which, in terms of a specially designed simulation language, allows the economic building of simulation models of any industrial plant. ***K. D. Tocher.*** *Operational Research Quarterly*, v. 11, nos. 1-2, Mar.-June 1960, p. 50-65.

13807 Organizing the Technical Conference. Intended to help guide those who wish to plan or participate in a conference. Although technical, scientific, professional, and committee conferences, specifically, are discussed, the basic concepts presented will be of use to many other groups as well. Discussion is focused on organizing small gatherings. ***Herbert S. Kindler.*** 139 pp. 1960. Reinhold Publishing Corp., New York. (AS6 K57o)

13808 How Power Affects Employe Appraisal. Employee morale depends a great deal on the way a supervisor handles employee evaluations. You will do well to remember these points whenever you are being appraised or when you are appraising others. ***Robert R. Blake and Jane S. Mouton.*** *Petroleum Refiner*, v. 39, Aug. 1960, p. 141-144.

ORE AND MATERIALS BENEFICIATION

13809 Gaseous Reduction of Fine Iron Ores in the Fluidized State. *S. Y. Ezz.* *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 4, Aug. 1960, p. 709-715.

13810* Effects of the Relative Size of Grains and Air Bubbles on the Adhesive Power Value. In a flotation cell, when the dimension of the air-introducing opening increases, the bubbles increase also. With a long-shaped, square opening, smaller bubbles arise than with a circular opening of equal size. (*In Hungarian.*) A szemnagyság és légbuborék relativ nagyságának befolyása a tapadási erő értékére. ***Szilveszter Pethő.*** *Bányászati Lapok*, v. 93, no. 7, July 1960, p. 465-470.

13811 Softening Temperatures of Fluxed Sinters From Rich and Lean Ores. Tabulation of the effect of mineral composition on softening temperatures of 24 compositions of C. P. silica, calcium oxide, and ferric oxide. ***Yu. M. Potebnya.*** *Henry Brutcher Translation No.* 4737, 19 pp. (Translated from *Izvest. VUZ-Chern. Met.*, no. 9, Sept. 1958, p. 3-14.) Henry Brutcher, Altadena, Calif.

13812 New Results in the Sintering of Iron Ores With Blast Furnace Gas Serving as Supplementary Fuel. A new sintering practice that compensates for a good portion of the heat deficiency commonly encountered at the start of the process. ***J. Holzhey.*** *Henry Brutcher Translation No.* 4831, 20 pp. (Translated from Neue Hütte, v. 5, no. 3, 1960, p. 143-148.) Henry Brutcher, Altadena, Calif.

13813 Flotation Switch Cuts Phosphate Costs. Tests demonstrate that the process saves 30% in major equipment investment and 20% in operating costs. *Chemical Week*, v. 87, no. 13, Sept. 24, 1960, p. 75 + 2 pages.

13814* Uranium Ore Beneficiation. ***A. B. VanCleave.*** *Chemistry in Canada*, v. 12, Aug. 1960, p. 34-35.

13815* The Use of Radioisotopes for the Study and Control of Flotation Processes. Radiometric and microautoradiographic methods were used in investigating the layers forming on the surface of particles of minerals within a range of thickness comparable with a monomolecular layer. The studies indicated some causes of the difficult flotability of pyrrhotine and zinc blend; the characteristics of the adhesion of xanthogene on the surface of sulfide minerals, and of kerosene on molybdenite; the combined action of xanthogenates of different alcohols; and the reaction of the cation collector with hübnerite and tungstate. (*In Russian.*) Primenenie radioaktivnykh izotopov dlia issledovaniia flotatsionnykh protsessov. ***I. N. Plaksin, S. N. Zaitseva, G. N. Khazhinskaia, and R. Sh. Shafeer.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 24 pp. (QC770 C76pr)

13816 The Processing of Uranium Ore Concentrates and Recycle Residues to Purified Uranyl Nitrate Solution at Springfields. ***H. Page, L. P. Shortis, and J. A. Dukes.*** *Institution of Chemical Engineers, Transactions*, v. 38, no. 4, 1960, p. 184-196.

13817 Non-Traditional Processes for Iron-Ore Reduction. Research in this field in many parts of the world was given a new impulse by the shortage of coke. The low-shaft furnace appears to be the only new process capable of industrial application. The processes which use electric power for thermal purposes are not yet economical. ***A. Scortecci and A. Palazzi.*** *Iron and Steel Institute, Journal*, v. 195, pt. 3, July 1960, p. 267-278.

13818* Electrostatic Separation of Minerals. In electrostatic ore beneficiation, the drum separator is very efficient in spite of apparently irremediable disadvantages. The separator with an electrical contact is very productive; its restricted use may be explained by a slight heating of the material and the insufficient height of the deflecting electrodes. The tubular drum separator possesses real advantages, but requires further development in design from the viewpoint of production. (*In Russian.*) Elektrostaticheskoe razdelenie mineralov. ***V. N. Glazanov and A. D. Rudenko.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1960, no. 4, p. 32-38.

13819 Italy Investigates Direct Reduction of Iron Ore. Reduction with natural gas will take place in a shaft-furnace pilot plant being built in Genova and financed by the European Coal and Steel Community. ***Antonio Scortecii.*** *Journal of Metals*, v. 12, Aug. 1960, p. 634-635.

13820 Development of a Thermoadhesive Method for Dry Separation of Minerals. This new system, specifically aimed at the beneficiation of rock salt, is based on salt's ability to transmit radiant heat. The particles are fed over a belt coated with a heat-sensitive substance so that the warm impure particles would adhere preferentially to the coating. Describes the course of the project from selection of the heat source through the design of a separator of pilot-plant size. Other possible applications and variations are cited where this process may enjoy similar success. ***R. J. Brison and O. F. Tangel.*** *Mining Engineering*, v. 12, Aug. 1960, p. 913-917.

13821 Beneficiation of Rock Salt at the Detroit Mine. Mineral Separation by the Thermoadhesive Method. Describes the installation and operation of a 500-tons-a-day plant at the International Salt Mine. Illustrates engineering details of the equipment. The plant is flexible in that it can be adjusted to produce either a substantially improved rock salt (98% NaCl) with a high recovery of salt or, conversely, a higher quality rock salt (99% NaCl) at lower recovery. Considers product quality and costs. ***W. C. Bleimeister and R. J. Brison.*** *Mining Engineering*, v. 12, Aug. 1960, p. 918-921.

13822* Arsenic Problem of Marietta Gold Ore Finally Solved by Selective Flotation. ***William Rogers Wade.*** *Mining World*, v. 22, no. 10, Sept. 1960, p. 38-41.

13823 Fluorspar and Its Beneficiation. Presents world occurrences of fluorspar with special reference to Indian deposits. Samples assaying 46, 56, and 21% CaF_2 could be successfully beneficiated by froth flotation to yield fluorspar concentrates of 80-98% purity, with recoveries ranging from 90-60% CaF_2. ***P. V. Raman and P. I. A. Narayanan.*** *NML Technical Journal*, v. 11, no. 1, May 1960, p. 18-22.

13824* Hydrostatic Balance and Its Use for the Operational Control of Coal-Preparation Plants. The principle of using hydrostatic balances to determine the ash content in coal washing products. (*In Czech.*) Hydrostatické váhy a jejich použití při kontrole provozu uhelných prádel. ***O. Radek.*** *Paliva*, v. 40, no. 7, July 1960, p. 212-215.

13825* Pre-Concentration of a Pitchblend Ore by Flotation. Laboratory tests showed that good yields (over 85%) were obtained if the concentration was kept to a moderate rate. (*In French.*) Préconcentration par flottation d'un minerai à pechblende. ***A. Ginocchio.*** *Revue de l'Industrie Minérale*, v. 42, no. 6, June 1960, p. 552-558.

13826* Some Factors Which Influence the Selectivity in Differential Flotation of Lead-Zinc Ores, Particularly in the Presence of Oxidized Lead Minerals. (*In French.*) Quelques facteurs influençant la sélectivité dans la flottation différentielle des minerais plomb-zinc, particulièrement en présence des minéraux oxydés du plomb. ***M. Rey and V. Formanek.*** *Revue de l'Industrie Minérale*, v. 42, no. 6, June 1960, p. 559-568.

13827* On the Scatter of Flotation Test Results Obtained in the Laboratory. Attemp to Improve the Flotation Apparatus for Laboratories. (*In French.*) De la dispersion des résultats des essais de flottation effectués en laboratoire. Tentative de perfectionnement des machines de flottation de laboratoire. ***P. Raffinot.*** *Revue de l'Industrie Minérale*, v. 42, no. 8, Aug. 1960, p. 654-668.

13828* The Forrer Separator, a New Apparatus for the Wet-Sorting of Slightly Paramagnetic Substances. (*In French.*) Le séparateur Forrer, un nouvel appareil pour trier dans l'eau des substances faiblement paramagnétiques. ***J. de Robert and L. Casnabet.*** *Revue de l'Industrie Minérale*, v. 42, no. 8, Aug. 1960, p. 669-677.

13829* A Resin-in-Pulp Process Using a Floating Resin Technique for Extracting Uranium From Acid Leached Pulp. ***E. H. D. Carman.*** *South African Institute of Mining and Metallurgy, Journal*, v. 60, no. 12, July 1960, p. 647-662.

13830 Tributyl Phosphate Extraction of Uranium From Ammonium Nitrate Solutions. The U distribution data required for the ammonium nitrate salted feed resulting from the ammonium fluoride dissolution-barium fluozirconate head-end flowsheet for STR-type fuel have been obtained with 5, 10, and 20% tributyl phosphate. ***R. A. Kent and K. L. Rohde.*** *U. S. Atomic Energy Commission, IDO*-14501, July 22, 1960, 16 pp. (UF767 Un3.1id Contin.)

13831 Preparation of Dense, Spheroidal UO_2. Methods used employ precipitations from aqueous media. The size and shape of the agglomerates in these precipitates fix the ultimate size and shape of the fired UO_2 particles. ***R. P. Levey, Jr.*** *U. S. Atomic Energy Commission*, Y-1299, May 2, 1960, 25 pp. (UF767 Un3.1y Contin.)

13832 Concentrating Argillaceous Surface Iron Ore of Tuscaloosa County, Alabama, by Washing. Development of a simple method of producing low-phosphorus hematite concentrates from certain submarginal southeastern irons ores. Seeks operating techniques that would make it profitable to use the marginal ores of this area for blast-furnace feed. ***I. L. Feld, R. E. Perry, and W. E. Lamont.*** *U. S. Bureau of Mines Report of Investigations* 5623, 1960, 15 pp. (TN21 Un3r Room 290)

13833 Acid Leaching of Oxidized Copper Ores by Downward Percolation. ***W. A. McKinney and Carl Rampacek.*** *U. S. Bureau of Mines Report of Investigations* 5629, 1960, 16 pp. (TN21 Un3r Room 290)

13834 Laboratory Treatment of California and Nevada Manganese Ores by Sulfation-Reduction and Other Methods. Describes further research by the Bureau of Mines in beneficiating domestic Mn ores. Studies reported here were directed

toward sawdust or lignin-sulfonates as reducing agents. ***A. L. Engel and H. J. Heinen.*** *U. S. Bureau of Mines Report of Investigations* 5641, 1960, 10 pp. (TN21 Un3r Room 290)

See also: **13395** (fine coal preparation).

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13835 Sound Source Near a Velocity Discontinuity. The far-field solution for a line and a point source near a tangential velocity discontinuity was calculated by summing (integrating) the plane waves that make up the source. The exact field integrals were evaluated approximately by the stationary-phase method, and this approximation gives the far field. It was found that the sound was strongly peaked in some directions, and considerably reduced in others. This angular dependence is shown graphically for certain cases. The physical significance of these results is discussed for both subsonic and supersonic motions, and the relationship to the jet-noise problem is suggested. ***Peter Gottlieb.*** *Acoustical Society of America, Journal*, v. 32, Sept. 1960, p. 1117-1122.

13836 On the Theory of Cooperative Phenomena in Crystals. Develops general theory of regular assemblies, and formulates the basic mathematical problem which they pose. The relationship of various simplified physical models to this problem is established. It attempts to give an account of the exact information which is available. The main emphasis is on the physical conclusions, but some effort has also been made to summarize the important mathematical methods. Another paragraph deals with approximate methods, particular consideration being paid to the systematic development of successive approximations. ***C. Domb.*** *Advances in Physics*, v. 9, no. 34, Apr. 1960, p. 149-153.

13837* The Statistical Theory of a Non-Linear Field. Shows that all the quantum effects can be considered as the result of a reaction between the classical system and the actual mass with an "imaginary" thermostate, that is a system consisting of particles of an imaginary mass in a state of statistical equilibrium. The Plank constant thus acquires a value proportional to the temperature of the imaginary thermostate multiplied by some constant having time dimensions. (*In Russian.*) K statisticheskoĭ teorii nelineĭnogo polia. ***Ia. P. Terletskiĭ.*** *Akademiia Nauk SSSR, Doklady*, v. 133, no. 3, July 1960, p. 568-571.

13838 Hyperfine Interaction and the Knight Shift. The difference between the magnetic field at which a specific nuclear magnetic resonance occurs in a metal and the field at which the same resonance occurs in a nonmetallic compound is known as the Knight shift. An elementary derivation of the relationship between the Knight shift and the electronic wave functions is presented here. The current experimental and theortical situation is briefly reviewed. ***F. J. Milford.*** *American Journal of Physics*, v. 28, no. 6, Sept. 1960, p. 521-527.

13839 Single-Domain Particles: New Uses of Old Theorems. Describes some applications of potential theory and classical dynamics to one field of current research, the theory of magnetization processes in "hard" magnetic materials. In very fine particles, the exchange forces responsible for the spontaneous magnetization keep it uniform in direction within any one particle; the magnetization curve is then determined by rotations of the particle magnetizations. ***William Fuller Brown, Jr.*** *American Journal of Physics*, v. 28, no. 6, Sept. 1960, p. 542-551.

13840 Method of Recording Low-Angle X-Ray Scattering When Intensity Scattered by Specimen Changes Rapidly With Time. Describes a new technique for the collection of scattered X-ray intensity data at low angles. The technique is applicable to specimens producing scatter that is time variant. The use of the method is illustrated by an example taken from an age hardening Al-Zn alloy. Discusses two methods of recording the intensity data and belief is that an improvement in the facility of recording could be obtained by the use of proportional counting. ***P. W. Teare.*** *British Journal of Applied Physics*, v. 11, July 1960, p. 287-289.

13841* The Calculation of the Electromagnetic Field in an Alvarez Type Linear Accelerator. A recently developed theory of the electromagnetic field in nearly periodic structures is used to calculate the field in an Alvarez type linear accelerator. The problem is reduced to the solution of the transmission line equations for the "voltage" and "current" of the dominant mode. ***Fred Ford.*** *Cambridge Philosophical Society, Proceedings*, v. 56, pt. 3, July 1960, p. 252-268.

13842* On Two-Dimensional Waves in an Elastic Half-Space. Two-dimensional elastic waves in a half-space $0 \leq r < \infty$, $0 \leq \theta \leq \pi$ are examined under the assumption of dynamic similarity, so that the stresses depend only on r/t, θ. Analytic solutions are given for constant surface traction on $\theta = 0$, $0 < r/t < V$, where V is constant, the rest of the surface being unloaded, and for a concentrated load at $r = 0$. ***J. W. Craggs.*** *Cambridge Philosophical Society, Proceedings*, v. 56, pt. 3, July 1960, p. 269-285.

13843* On the Temeprature Dependence of the Shape of Paramagnetic Resonance Lines. A theory of the temperature dependence of the shape of paramagnetic resonance lines is developed for temperatures sufficiently low to make the effects of the spin-lattice interaction and thermal expansion negligible. General expressions for the first and second moments of the line shape function as functions of the temperature are obtained, and the approximations used are discussed in detail. These expressions are applied to the case of effective spin $S = \frac{1}{2}$ and 1. As an illustration of the general theory, numerical results are given for the paramagnetic resonance lines of nickel fluosilicate. In this case, the moments become strongly temperature dependent below 10 K. ***Malcolm McMillan and W. Opechowski.*** *Canadian Journal of Physics*, v. 38, Sept. 1960, p. 1168-1186.

13844* Direct Conversion of Energy to Electricity. A synopsis of current methods used in every conversion system. ***R. C. Ulmer and J. D. Sensenbaugh.*** *Combustion*, v. 32, no. 2, Aug. 1960, p. 30-38.

13845* Developing a Highly Ionized Plasma by Combining the Clipping Effect With a Crescent-Like Magnetic Geometry. An assembling scheme is described, giving a hot plasma owing to two successive discharges, the latter operating on the basis of the crescent-like shape imagined by Grad, which stably confines the hot plasma created. (*In French.*) Réalisation d'un plasma fortement ionisé grâce à la combinaison de l'effet de pincement et d'une géométrie magnétique en "croissants". ***Jean-Paul Watteau.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 4, July 25, 1960, p. 532-534.

13846* Cyclotron Resonance in Solids. A new kind of experiment is described which measures the "effective mass' of mobile electrons in semiconductors and metals. Samples are placed in a magnetic field which causes the charge carriers to move in circular paths, and a microwave oscillating electric field accelerates them in the same way as charged particles in a vacuum are accelerated in a cyclotron. The effective mass thus determined measures the momentum transfer between the crystal lattice and the electron waves and thus gives detailed information about the nature of the conduction electron states. ***Arthur F. Kip.*** *Contemporary Physics*, v. 1, no. 5, June 1960, p. 355-369.

13847* Magnetohydrodynamic Waves. The fundamental concepts of magnetohydrodynamics are presented, and Alfvén waves are discussed in terms of a simple physical picture. The applications of magnetohydrodynamic wave theories are shown to give explanations of astrophysical phenomena, and experimental evidence for the basic theory is described. ***D. F. Jephcott.*** *Contemporary Physics*, v. 1, no. 5, June 1960, p. 385-389.

13848* The Basic Equations of the Dynamics of the Continuous Distribution of Dislocations. I. General Theory. The basic equations of the dynamics of the continuous distribution of dislocations analogical to Maxwell's equations are derived in a series of papers I, II, III. The analogy of the elastic and electromagnetic fields is analyzed. Basic equations of the continuous distribution of dislocations are derived for the dynamic case, especially for small deformations and for the Poisson ratio equal to zero in a continuum, infinite with respect to space and time, from the variational problem by means of the formal apparatus of the special theory of relativity. ***E. F. Holländer.*** *Czechoslovak Journal of Physics*, v. 10, no. 6, 1960, p. 409-418.

13849* Some Applications of the Discrete Fourier Transform to Problems or Crystal Lattice Deformation I. The theory of the discrete Fourier transform [1], [2] is applied in solving a system of difference equations describing the positions of atoms in a deformed crystal lattice. The crystal lattice is approximated by the Born-Kármán model modified to include the internal energy of the undeformed crystal. ***I. Babuška, E. Vitásek, and F. Kroupa.*** *Czechoslovak Journal of Physics*, v. 10, no. 6, 1960, p. 419-427.

13850* Some Applications of the Discrete Fourier Transform to Problems of Crystal Lattice Deformation II. The method elaborated in [1] is applied to the solution of some problems for a plane lattice and the linear chain. The method can be used to investigate deformations around crystal lattice defects. ***I. Babuška, E. Vitásek, and F. Kroupa.*** *Czechslovak Journal of Physics*, v. 10, no. 7, 1960, p. 488-504.

13851* The Influence of the Initial Conditions on the Pressure Decrease During Ionic Pumping. Gives a description of the experimental investigation in the influence of the initial pressure and method of outgassing an evacuated system on the pressure decrease during pumping with an ionization gage. Measurements were carried out in a system containing two ionization gages and two valves using the method of cascade pumping. Conclusions as to the influence of these conditions on the pressure decrease are reached on the basis of the measurements and the causes of this influence are discussed. ***L. Pátý and P. Schürer.*** *Czechoslovak Journal of Physics*, v. 10, no. 7, 1960, p. 536-543.

13852* On the Ferromagnetism of Thin Films. The magnetic properties of ferromagnetic thin layers are studied by calculating the partition function for the magnetic system in Kirkwood's approximation of the second order. The results obtained for the Curie temperature and the magnetization are in somewhat better agreement with the experiment than those obtained by Valenta. ***A. Corciovei.*** *Czechoslovak Journal of Physics*, v. 10, no. 8, 1960, p. 568-578.

13853 High-Energy Electron Scattering Tables. ***Robert Herman and Robert Hofstadter.*** 278 pp. 1960. Stanford University Press, Stanford, Calif. (QC721 H42h)

13854* The Dirac Equation for Many-Electron Systems. Points out that the Dirac equation is simply the eigenvalue equation of the magnitude of the momentum four-vector, and can be derived by expressing the magnitude of the momentum vector in terms of its four components. ***K. S. Viswanathan.*** *Indian Academy of Sciences, Proceedings*, v. 52, sec. A, no. 1, July 1960, p. 35-45.

13855* Effects of Gamma Radiation on the Dielectric Properties of Some Electric Insulating Materials. II. Phenol-Formaldehyde Plastics. When irradiating plastic material such as AG-4, K-114-35, K-211-3 and FKPM-25 with 30,000-100,000 r at 500-530 r/m, the loss of conductivity increases especially in K-114-35. The most important angles of loss are observed after radiation at −60 C and under tropic conditions (AG-4). The electric strength of the plastics investigated did not change practically after γ-radiation. Specific inductive capacitance remained the same. (*In Russian.*) Vliianie gamma-izlucheniia na dielektricheskie svoĭstva nekotorykh elektroizoliatsionnykh materialov. II. Fenol'no-formal'degidnye platmassy. ***K. A. Vodop'ianov, B. I. Vorozhtsov, and G. I. Potakhova.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Fizika*, 1960, no. 3, p. 133-137.

13856 Electromagnetic Theory of dc Effects in Ferromagnetic Resonance. Studies effects of magnetoresistance and extraordinary Hall effect on the propagation of electromagnetic waves through very thin sheets of ferromagnetic conductors. These contributions to the conductivity produce electric fields varying like products of current and magnetization, and introduce nonlinear interactions, which are particularly large in the neighborhood of ferromagnetic resonance. Detailed first-order dc electric fields are obtained for the configuration of a very thin ferromagnetic sheet very close to a conducting wall. The results predict signals strictly proportional to incident microwave power, and mostly inversely proportional to film thickness, becoming independent of thickness for the thinnest films. ***H. J. Juretschke.*** *Journal of Applied Physics*, v. 31, Aug. 1960, p. 1401-1406.

13857 Plasma Propulsion by a Rapidly Varying Magnetic Field. Investigates the motion of a plasma under the action of a rapidly varying magnetic field from a stationary coil. The analysis has been done for two cases: (1) the plasma is assumed completely diamagnetic so that the ionization history of the plasma may be ignored; and (2) the nondiamagnetic case where the ionization process is considered in detail. The results show that the nondiamagnetic plasma yields an efficiency slightly less than that obtained for the corresponding diamagnetic plasma. The ionization process inside the plasma levels off very rapidly so that the electron density increases by only a few per cent during the motion of the plasma, but the amount of ionization has very little effect upon the efficiency of the system. Indicates that the efficiency of a plasma driven by a magnetic field from a stationary coil is probably too low for practical applications. ***Milton M. Klein and Keith A. Brueckner.*** *Journal of Applied Physics*, v. 31, Aug. 1960, p. 1437-1448.

13858 On Inversion of the Linear Laws of Irreversible Thermodynamics. ***Eugene Helfand.*** *Journal of Chemical Physics*, v. 33, Aug. 1960, p. 319-322.

13859* Balance Acceleration and Deflection Electrostatic Focusing. A suitable combination of acceleration focusing and deflection focusing leads to a model for a periodic electrostatic focusing system which is free from instabilities. Convenient electrode structures are shown which will approximate the required field; the resulting system should have only narrow bands of instability. This scheme also has the following characteristics which should make it suitable for incorporation in a tape-helix traveling-wave tube: the beam velocity varies in such a way that electrons spend most time between the central electrodes, and the beam thickness varies in such a way that the beam is thinnest where it passes the central electrodes. ***P. A. Sturrock.*** *Journal of Electronics and Control*, v. 8, no. 4, Apr. 1960, p. 267-272.

13860* Method of Measuring Spherical and Astigmatic Aberrations by Shadow Electron Microscope Images. In the electron microscope, Y. Sakaki and S. Maruse introduced the method of measuring the spherical aberration from the shadow image of a cross diffraction grating by the simple geometrical relation of concentration beams of different angles of illumination. The image formation of shadow image is further developed, based on the caustic theory. ***Koichi Kanaya and Hisazo Kawakatsu.*** *Journal of Electronmicroscopy*, v. 8, 1960, p. 1-3.

13861* On the Astigmation of Magnetic Electron Lens. Describes the astigmatism of magnetic electron lens caused by the defect of the material used in pole-pieces. Studies the relation between the astigmatic difference and the lens excitation and finds that astigmatic difference is too large at weak excitation to be expected from the geometrical asymmetry of the lens and decreases rapidly to a constant value with the increase of lens excitation. ***Shinjiro Katagiri.*** *Journal of Electronmicroscopy*, v. 8, 1960, p. 13-16.

13862 Non-Crystalline Solids. Discusses scattering of radiation by noncrystalline media, spherically symmetric Fourier transforms, electron diffraction techniques for the study of amorphous systems, structure of vitreous silica, high temperature X-ray diffraction methods, electronic band structure of one-dimensional disordered arrays, X-ray absorption edge spectroscopy of compounds of Cr, Mn, Co, magnetic resonance studies of glasses, and other problems. ***V. D. Fréchette, editor.*** 536 pp. 1960. John Wiley & Sons, New York. (QC176 C76n)

13863 Analysis of Elliptically Polarized Light. Exact equations for the analysis of elliptically polarized light with a non-exact quarter-wave compensator are developed. Describes procedures for calibrating a quarter-wave compensator. ***Robert C. Plumb.*** *Optical Society of America, Journal*, v. 50, Sept. 1960, p. 892-894.

13864 Comparison of the Rayleigh and Jamin Types of Interferometers. When the width and location of the diaphragms which limit the interfering light beams in Jamin type interferometers are changed, these interferometers become similar to Rayleigh type interferometers. A general formula for the dependence of the contrast of fringes on the width of the light source and on other factors is obtained for both types of interferometers. ***Yu. V. Kolomiitsov.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 8, no. 5, May 1960, p. 370-375.

13865 Nuclear Magnetic Resonance in Lithium and Dilute Lithium-Magnesium Alloys. The Knight shift and linewidth of the ^{7}Li resonance in dilute Li-Mg alloys was investigated. The observed rapid fall in Knight shift with alloying concentration is interpreted using Drain's theory. Linewidth measurements show that the activation energy of self-diffusion of the ^{7}Li atoms increases from 13·1 ± 0·2 kcal/mole for pure Li to 14·5 ± 0·3 kcal/mole for the 10 at.% Mg alloy. ***D. G. Hughes.*** *Philosophical Magazine*, v. 5, ser. 8, May 1960, p. 466-471.

13866 Approach to Equilibrium in Quantal Systems: Magnetic Resonance. Presents a derivation of the "master" or Boltzmann "gain-loss" equation from the Schrodinger equation, i.e., a derivation of the equation for the evolution in time of the probabilities of finding a physical system in its various states from the equation for the corresponding probability amplitudes. As illustrations of the general methods developed, two important processes in magnetic resonance—the time variation of the longitudinal magnetization, $(\mu)_t$, and the time variation of the transverse magnetization $(\mu')_t$—are discussed. ***A. Sher and H. Primakoff.*** *Physical Review*, v. 119, 2nd ser., no. 1, July 1, 1960, p. 178-207.

13867 Studies of Plasma Heated in a Fast-Rising Axial Magnetic Field (Scylla). Describes the Scylla plasma experiment, which employs a rapidly rising magnetic field in a cylindrical mirror geometry to produce and heat a deuterium plasma. ***K. Boyer, W. C. Elmore, E. M. Little, W. E. Quinn, and J. L. Tuck.*** *Physical Review*, v. 119, 2nd ser., no. 3, Aug. 1, 1960, p. 831-843.

13868 Continuum Radiation in the X-Ray and Visible Regions From a Magnetically Compressed Plasma (Scylla). The identification of a sharp low-wavelength cutoff in the spectrum of X-rays emitted from deuterium discharges in Scylla has resulted in the assignment of an electron temperature of 240±40 ev at the time of peak magnetic field compression. Simultaneous time-resolved absolute intensity determinations in the visible continuum, when coupled with the temperature measurement, yield an upper limit electron number density of $(5\pm1) \times 10^{16}/cm^3$ at peak compression. ***F. C. Jahoda, E. M. Little, W. E. Quinn, G. A. Sawyer, and T. F. Stratton.*** *Physical Review*, v. 119, 2nd ser., no. 3, Aug. 1, 1960, p. 843-856.

13869 Atomic Motions in Water by Scattering of Cold Neutrons. The inelastic scattering of cold neutrons, of energy about 4×10^{-3} ev, was used to study the atomic motions in water, mainly in the liquid phase. As a result of the incoherent nature of scattering by protons, the interpretation of the energy changes in terms of atomic motions is particularly simple. The water samples used were extremely thin in order to avoid multiple scattering effects. Instead of the smooth distribution in energy of the scattered neutrons expected for a classical liquid, the experimental results exhibit a number of distinct energy changes. ***D. J. Hughes, H. Palevsky, W. Kley, and E. Tunkelo.*** *Physical Review*, v. 119, 2nd ser., no. 3, Aug. 1, 1960, p. 872-881.

13870 Nuclear Magnetic Resonance in Copper Alloys. Electron Distribution Around Solute Atoms. Describes effects of the addition to Cu of a wide variety of B subgroup elements on the nuclear magnetic resonance absorption of Cu. ***T. J. Rowland.*** *Physical Review*, v. 119, 2nd ser., no. 3, Aug. 1, 1960, p. 900-912.

13871 Galvanomagnetic and Thermomagnetic Potentials in Zinc at Liquid Helium Temperatures. The Hall effect, magnetoresistance, thermoelectric voltage, and transverse Ettingshausen-Nernst potential were measured in a single crystal of Zn in the liquid He temperature range. Oscillations as a function of magnetic field strength were observed in all of these potentials. ***C. J. Bergeron, C. G. Grentier and J. M. Reynolds.*** *Physical Review*, v. 119, 2nd ser., no. 3, Aug. 1, 1960, p. 925-934.

13872 Auger Electron Ejection From Germanium and Silicon by Noble Gas Ions. Experimental results concerning electron ejection from annealed, atomically clean surfaces of Ge and Si by the singly charged ions of the noble gases. Since these experimental results are subsequently to be interpreted theoretically, identification of the results with the theoretical ideas only is given. ***Homer D. Hagstrum.*** *Physical Review*, v. 119, 2nd ser., no. 3, Aug. 1, 1960, p. 940-952.

13873 Atomic-Beam Measurement of the Hyperfine Structure and Nuclear Moments of Iodine-131. The nuclear magnetic dipole and nuclear electric quadrupole interaction constants a and b were measured in 8-day iodine-131 by an atomic beam magnetic resonance experiment. The results are $a = 575.903\pm0.007$ Mc/sec, $b = 578.866\pm0.075$ Mc/sec. The zero-field hyperfine splittings computed from these values of a and b are $\Delta\nu(5,4) = 3292.99\pm0.09$ Mc/sec, $\Delta\nu(4,3) = 2138.22 \pm0.05$ Mc/sec, $\Delta\nu(3,2) = 1314.24=0.07$ Mc/sec. The nuclear magnetic dipole moment and nuclear electric quadrupole moment are calculated as $\mu_{131} = 2.738\pm0.001$ nm, $Q_{131} = -0.41\pm 0.01 \times 10^{-24}$ cm^2. The value of μ_{131} obtained here differs slightly from that obtained by other workers, while the value of Q confirms an earlier measurement made by a different method. ***Edgar Lipworth, Hugh L. Garvin, and Thomas M. Green.*** *Physical Review*, v. 119, 2nd ser., no. 6, Sept. 15, 1960, p. 2022-2025.

13874 Ground and Excited States of a Many-Body System With Singular Interaction. The procedure to get the ground-state energy and excitation spectrum by looking at the normal modes for the simple excitations of a many-body system is extended and applied to a system with singular interactions. It is shown that the singular two-body interaction can be consistently replaced by the so-called reaction matrix in the equations of motion and in the expressions for the energies of ground and excited states. ***Katuro Sawada.*** *Physical Review*, v. 119, 2nd ser., no. 6, Sept. 15, 1960, p. 2090-2097.

13875* Theory of a Heisenberg Ferromagnet in the Random Phase Approximation. In this preliminary account we restrict ourselves to spin one-half and to a study of magnetic properties alone. The principal result of the analysis is a magnetization curve which imitates conventional spin wave theory very closely but with the existence of renormalized spin wave frequencies. ***F. Englert.*** *Physical Review Letters*, v. 5, no. 3, Aug. 1, 1960, p. 102-103.

13876 SCEPTRE III—An Intense Source of the Spectra of Highly Ionized Atoms. This study draws attention to the potentialities of the high-current toroidal discharge assembly, SCEPTRE, as an intense source of the higher spectra. Reports several new classified lines of Ne IV, V, and VI which were observed in the range 2200 to 2300 Å, thus permitting some revision of, and extension to, the analyses of these spectra. The complete F VI triplet $3s^3S\text{-}3p^3P^o$ was also observed for the first time. Gives two new experimental methods of differentiating between the stages of ionization. With SCEPTRE, in contrast to conventional sources of spark spectra, gaseous samples are easily introduced into the deuterium plasma. Thus, such a discharge apparatus will be of value in exciting the spectra of the rare gases. Presents experimental evidence to show that the contribution of the Spark effect to the large observed widths of O V and F VI lines is very small. Gives consideration to the detection of the coronal lines with SCEPTRE and to their value in studying ion motion within the plasma. ***A. S. Kaufman, T. P. Hughes, and R. V. Williams.*** *Physical Society, Proceedings*, v. 76, pt. 1, July 1960, p. 17-24.

13877 Ion Charge Exchange Reactions in Oxygen Afterglows. Describes a method for measuring cross sections for ion charge exchange at mean ion energies corresponding to gas temperatures of the order of 300 K. The measurements are made in afterglows following pulsed radio-frequency gas discharges, using a mass spectrometer to identify the ions present, and to observe their relative rates of change of population. ***P. H. G. Dickinson and J. Sayers.*** *Physical Society, Proceedings*, v. 76, pt. 1, July 1960, p. 137-148.

13878 Waves in a Conducting Sheet Situated in a Strong Magnetic Field. The hydromagnetic approximation is applied to the elementary linear theory of transverse waves in a thin uniform plane conducting sheet, in which the inertia is provided by the sheet, and the restoring forces by strong vacuum magnetic fields on either side of the sheet. ***I. C. Percival.*** *Physical Society, Proceedings*, v. 76, pt. 3, Sept. 1960, p. 329-336.

13879 The Optical Absorption in Manganese Zinc Fluoride Single Crystals Near the Néel Temperature. The visible and ultraviolet absorption spectra of single crystals of manganese fluoride, and of two manganese zinc fluoride mixtures, were

measured down to 62 K. The sharp lines arising from the level complexes $\{ {}^4E_g {}^4A_{1g} \}$ (^4G) and ^2E_g(^2D), which are insensitive to the magnitude of the crystalline electrostatic field, show a nonlinear shift with temperature, which varies with composition. ***D. M. Finlayson, I. S. Robertson, T. Smith, and R. W. H. Stevenson.*** *Physical Society, Proceedings*, v. 76, pt. 3, Sept. 1960, p. 355-368.

13880 Measurement of Ionization and Attachment Coefficients in Carbon Dioxide in Uniform Fields. Contrary to statements in the literature, allowance must be made for electron attachment which, in fact, is greater than that in dry air in comparable conditions, and consequently is easily measurable. The electron energy distribution in the present experiments must differ appreciably from the Maxwellian or Druyvesteyn forms. ***M. S. Bhalla and J. D. Craggs.*** *Physical Society, Proceedings*, v. 76, pt. 3, Sept. 1960, p. 369-377.

13881* A New Approach to the Theory of Classical Fluids. I. An exact integral equation is found for the pair distribution function. The Helmholtz free energy is expressed as a series expansion which may be more rapidly convergent than the usual one. Shows that the integral equation can be derived also by means of a variational principle from the expression for the free energy. Points out that the theory of classical fluids may be constructed with the knowledge of the pair distribution function alone, even if a form of the pair interaction potential is not known. ***Tohru Morita and Kazuo Hiroike.*** *Progress of Theoretical Physics*, v. 23, no. 6, June 1960, p. 1003-1027.

13882 Radiation Pyrometry and Its Underlying Principles of Radiant Heat Transfer. General principles, blackbody radiation, non-blackbody radiation, radiation pyrometers, emittance corrections are discussed and tables, charts and references are cited. ***Thomas R. Harrison.*** 234 pp. 1960. John Wiley & Sons, New York. (QC338 H24r)

13883 Reports on Progress in Physics. A collection of ten papers from all areas of physics. ***A. C. Stickland, editor.*** v. XXIII. 629 pp. 1960. The Physical Society, London. (QC3 P56r Vis.)

13884 Accurate Electronic Wave Functions for the H_2 Molecule. Discusses accurate wave functions for the ground state, evaluation of the relative elements, accurate wave functions for excited states, approximate wave functions for the ground state, and expectation values of various operators for the ground state. ***W. Kolos and C. C. J. Roothaan.*** *Reviews of Modern Physics*, v. 32, no. 2, Apr. 1960, p. 219-232.

13885 Thermocouple Probe Design Method. Provides suitable environment for measuring gas temperatures. Stagnation tube reduces velocity error. ***Laurence B. Haig.*** *SAE Journal*, v. 68, Aug. 1960, p. 81-84.

13886 High Magnetic Field Research. Magnetic pressure can move mountains of metal or plasma for the engineer, and atoms for the physicist. ***Harold P. Furth.*** *Science*, v. 132, Aug. 12, 1960, p. 387-393.

13887* On the Method of Measuring Hall Coefficient at Microwave Frequencies. A theory of the method of measuring Hall coefficient at microwave frequencies by using the bimodal or dual-mode cavity was developed. It is a straight application of the method developed by Slater in treating microwave resonant cavities. ***Kazuo Yamagata.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 12, no. 3, June 1960, p. 235-246.

13888 The Production by Surface Currents of Magnetic Fields Suitable for Spiral Ridge Accelerators. The field is required to be zero outside the region of the current distributions and where media of two different permeabilities are used. The problem is reduced to the design of an "elmentary magnet". The final accelerator magnet can be formed of a single such magnet or built up using a number of them. ***Edward S. Akeley.*** *U. S. Atomic Energy Commission, MURA*-569, Apr. 15, 1960, 27 pp. + 10 figures. (UF767 Un3.1mu Contin.)

13889 High-Energy Molecular Ion Injection Into a Mirror Machine. The device used an axial arc to dissociate and trap the ions. Multiple passes through the arc are obtained by injection at an angle and by processing the molecular ions so that they miss the inflector for a limited number of traversals of the machine length. The build-up was calculated in a time-dependent fashion, and a parameter study was made. ***F. C. Gilbert, W. Heckrotte, R. E. Hester, J. Killeen, and C. M. Van Atta.*** *U. S. Atomic Energy Commission, UCRL*-5827, Feb. 1960, 26 pp. (UF767 U3u Contin.)

13890 Photovoltaic Effect Produced in Silicon Solar Cells by X- and Gamma Rays. The open-circuit voltage and photocurrent produced in a silicon solar cell by X- and γ-rays were measured as a function of exposure dose rate, cell temperature, angle of incidence of radiation, and photon energy. This photoresponse was stable and proportional to the exposure dose rate, which was applied up to a maximum of 1.8×10^6 roentgen per min for X-rays and 4×10^3 roentgen per min for Co^{60} γ-rays. At an exposure dose rate of 1 roentgen per min the response was of the order of 10^{-5} v for the open-circuit voltage and 10^{-8} amp for the photocurrent. At high exposure dose rates of Co^{60} γ-rays, radiation damage became apparent. An approximate value of the thickness of the effective *p-n* junction layer is deduced from the energy dependence. ***Karl Scharf.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry*, v. 64A, no. 4, July-Aug. 1960, p. 297-307.

13891* Formation of the Optical Image of the Ferroelectric Domains of Rochelle-Salt Crystals. The following questions were investigated: Can the polarization optical processes of the Rochelle-salts in the ferroelectric domain be derived quantitatively from the crystal optical data and on the basis of which assumption related to the spatial arrangement of the domains, especially to their expansion in depth, is this possible? (*In German.*) Über das Zustandekommen der optischen Abbildung der ferroelektrischen Domänen von Seignettekristallen. ***Horst Flunkert.*** *Zeitschrift für Physik*, v. 159, no. 3, 1960, p. 253-271.

13892* Spectrum and Zeeman Effect of the Trivalent Praseodymium in the Hexagonal Ethyl Sulfate. The visible absorption spectrum of Pr^{3+}-ions in the hexagonal (Ce, Pr) ethyl sulfate and its Zeeman effect in the external magnetic field are recorded at 4.2 K and interpreted by assuming a crystal field of D_{3h} symmetry. The values of the crystal quantum number for the splitting component terms, some crystal field matrix elements and the Landé *g*-factors of the terms are determined. (*In German.*) Spektrum und Zeeman-Effekt des dreiwertigen Praseodyms im hexagonalen Äthylsulfat. ***K. H. Hellwege, G. Hess, and H. G. Kahle.*** *Zeitschrift für Physik*, v. 159, no. 3, 1960, p. 333-347.

13893* An Asymptotically Exact Solution for a Model Hamiltonian in the Theory of Superconductivity. The whole chain of equations for the Green's functions constructed on basis of the Bardeen, Cooper and Schriffer model Hamiltonian can be satisfied asymptotically. Thus, the asymptotic accuracy of the well-known solution for the superconducting state can be demonstrated without application of perturbation theory. The trivial solution corresponding to the normal state at a temperature below the critical should be rejected. (*In Russian.*) Asimptoticheski tochnoe reshenie dlia model'nogo gamiltoniana teorii sverkhprovodimosti. ***N. N. Bogoliubov, D. N. Zubarev, and Yu. A. Tserkovnikov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 39, no. 1(7), July 1960, p. 120-129.

13894* Experimental Investigation of the Plasma Breakdown in Magnetic Field. The plasma breakdown of He was studied when the basic mechanism of the breakdown consists in the diffusion of charged particles across a magnetic field. A super-high frequency method was used in determining the concentration of electrons. The tests were conducted at He pressures of 0.09 - 2 mm of the Hg column with magnetic field forces up to 1100 oersteds, within a range of concentrations of charged particles of 10^8-10^{11} $\frac{1}{cm^3}$. (*In Russian.*) Eksperimental'noe issledovanie diffuzionnogo raspada plazmy v magnitnom pole. ***V. E. Golant and A. P. Zhilinskiĭ.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 30, no. 7, July 1960, p. 745-755.

See also: **13488** (energy conversion); **13503** (thermoelectricity).

13895 In the Rocket Nozzle Environment—Pick the Right Plastic. Information is given on how to analyze the design, specify the parts, and get the quality. ***Wesley C. Mace.*** *Aircraft and Missiles*, v. 3, Oct. 1960, p. 44-45.

13896 Preparation of Polymeric Condensation Products Containing Functional Thiol Side Chains. Polyurethans. General method of synthesis for a polyurethan and a polyester containing free sulfhydryl groups. ***C. G. Overberger and Herbert Aschkenasy.*** *American Chemical Society, Journal*, v. 82, Aug. 20, 1960, p. 4357-4360.

13897 The Copolymerization of Benzene With Vinyl Acetate. Rate of polymerization of vinyl acetate in the undiluted state and in benzene solution was studied dilatometrically at 59.6° with α,α'-azobiscyclohexanecarbonitrile as the initiator. ***Leighton H. Peebles, Jr., John Thacher Clarke, and Walter H. Stockmayer.*** *American Chemical Society, Journal*, v. 82, Sept. 20, 1960, p. 4780-4785.

13898* Epoxidized Polyolefin Resins. A20 epoxy resins are epoxidized polyolefins which can be cured at room temperature with dibasic acid and anhydride curing agents. High flexural strengths, heat distortion temperatures, and superior age resistance are exhibited by the resin when cured with maleic anhydride and aliphatic polyols. ***Frank P. Greenspan, Chris Johnston, and Murray Reich.*** *Applied Plastics*, v. 3, Aug. 1960, p. 25-28.

13899 Recent Experience With Polycarbonates. Mechanical, thermal, electrical, processing and finishing. ***H. W. Streib.*** *British Plastics*, v. 33, Sept. 1960, p. 406-409.

13900 The Swelling and Fracture of Polythene Melts. Work reported here was undertaken to assist our blow molding work by evaluating the swelling characteristics of different materials, and also to obtain a better understanding of the mechanism of the swelling and melt fracture phenomena and their relationships with other melt flow properties of polythenes. ***D. L. T. Beynon and B. S. Glyde.*** *British Plastics*, v. 33, Sept. 1960, p. 414-419.

13901* Graft Polymerisation of Styrene on Pre-Irradiated Polythene Described. Discusses trapped radicals that are formed and used as active points of grafting of polystyrene chains onto the polythene chains. Studies the kinetics of the graft polymerization. *Chemical Age*, v. 84, Sept. 17, 1960, p. 429-430.

13902 Metal Ketyls as Initiators of Polymerisation of Vinyl Monomers. Polymerisation of Acrylonitrile and Methyl Methacrylate by Monosodium Benzophenone. Effects of concentration of catalyst, monomer, added benzophenone, and temperature on polymerization. ***Albert Zilkha, Pedatsur Neta, and Max Frankel.*** *Chemical Society, Journal*, 1960, Aug., p. 3357-3364.

13903* Fluorine Containing Polymers. Outstanding materials already available, and interesting new polymers at present under investigation. ***M. Stacey.*** *Engineering Materials and Design*, v. 3, Sept. 1960, p. 552-553.

13904* Medium Density Polythenes in Coatings. Ease of extrusion and good physical properties combine to make medium-density polythenes particularly useful in extrusion coatings. Medium-density polythenes give better performance at the same coating weight, or equivalent performance at lower weight, when compared with low-density resins. ***C. F. Inig and J. F. Morris.*** *Fibres and Plastics*, v. 21, Aug. 1960, p. 228-229.

13905* Some Aspects of the Polymerization of Cyclic Ethers. Review of the newer research on cyclic ethers with particular reference to knowledge of the reaction mechanisms. ***A. M. Eastham.*** *Fortschritte der Hochpolymeren-Forschung*, v. 2, no. 1, 1960, p. 18-50.

13906* Reaction of Organic Low Molecular Compounds by Cobalt-60 Gamma-Radiation. II. Polymerization of Styrene. Polymerization of styrene was studied with an additive by the irradiation of γ-rays at room temperature in vacuo. (*In Japanese.*) ***Motome Hamashima.*** *Government Chemical Industrial Research Institute, Tokyo, Reports*, v. 55, July 1960, p. 223-229.

13907 Chemical Principles of Solid Propellants. Thermochemistry, rheology, polymerization, mechanical properties, aging, and combustion. ***Eli Mishuck and L. T. Carleton.*** *Industrial and Engineering Chemistry*, v. 52, Sept. 1960, p. 754-760.

13908 Formulations and Quality Control in Polyurethane Propellants. Network concepts and a generalized correlation of mechanical properties are useful in systematizing solid-propellant formulation development and improving reproducibility. ***Harold E. Marsh, Jr.*** *Industrial and Engineering Chemistry*, v. 52, Sept. 1960, p. 768-771.

13909* Urethane Polyether Prepolymers and Foams. Influence of Chemical and Physical Variables on Reaction Behavior. ***H. G. Scholten, J. G. Schuhmann, and R. E. Ten Hoor.*** *Journal of Chemical and Engineering Data*, v. 5, no. 3, July 1960, p. 395-400.

13910 Paramagnetic-Resonance Studies of Irradiated High-Density Polyethylene. I. Radical Species and the Effect of Environment on Their Behavior. II. Effect of Irradiation Dose on the Radical Species Trapped at Room Temperature. Marlex-50 was irradiated at different temperatures with 800-kf (peak) electrons. It was examined for paramagnetic resonance at +25 and −196 C to determine the radical species and their postirradiation behavior as well as that of the crystalline trapping medium. ***Elliott J. Lawton, J. S. Balwit, and R. S. Powell.*** *Journal of Chemical Physics*, v. 33, Aug. 1960, p. 395-412.

13911 The Formation of a Cyclic Recurring Unit in the Polymerization of Diallyldimethylsilane. Diallyldimethylsilane was polymerized with Ziegler-type catalysts to give soluble polymers. ***C. S. Marvel and R. G. Woolford.*** *Journal of Organic Chemistry*, v. 25, Sept. 1960, p. 1641-1643.

13912* Block and Graft Polymerisation of Polymethyl Methacrylate Under the Influence of ^{60}Co-Gamma Rays. Using irradiation techniques, block and graft copolymers were prepared in which the main chain consists of polymethyl methacrylate and the side chains of polyacrylonitrile or polymethylacrylate. The behavior of the copolymers in the presence of solvents is described. Infrared spectroscopy was used in analyzing the materials. (*In German.*) Block- und Pfropfpolymerisationen an Polymethylmethacrylat unter dem Einfluss von ^{60}Co-Gamma-Strahlung. ***D. Hummel and Christel Schneider.*** *Kunststoffe*, v. 50, Aug. 1960, p. 427-431.

13913* Methods for the Synthesis of the Peptide Bond. A review of methods for peptide syntheses suitable for the preparation of polypeptides: the polycondensation of methylesters of oligopeptides, of thioesters, of azides, of chlorides, and of the N-phenylthiocarbonyl derivatives. Poly-α-amino acids of highest molecular weight are obtained from α-amino acid N-carbonic anhydrides with strong bases as starting compounds. (*In German.*) Methoden zur Knüpfung der Peptidbindung. ***Th. Wieland.*** *Makromolekulare Chemie*, (Symposium Über Makromoleküle in Wiesbaden, 1959), v. 35A, July-Aug. 1960, p. 65-73.

13914* Kinetic Study on the Reaction of Polyvinyl Chloride Thermal Dehydrochlorination. Studies the kinetics of the thermal dehydrochlorination of polyvinyl chloride in the temperature range 180-250 C in an inert and O-containing atmosphere. Shows the effect of the molecular weight of the polymer on the dehydrochlorination rate. When the thermal degradation occurs in presence of O, the reaction becomes autocatalytic and the activation energy dehydrochlorination is strongly lowered. Reviews the literature on the thermal polyvinyl chloride degradation and discusses and interprets experimental results. ***G. Talamini and G. Pezzin.*** *Makromolekulare Chemie*, v. 39, nos. 1-2, July 1960, p. 26-38.

13915* Polymerization of Diketene. Mercuric chloride diketene was converted easily to polymer whose molecular weight was about 1630. The structure of the polymer was assumed to be of polyester structure. ***Junji Furukawa, Takeo Saegusa, Noritoshi Mise, and Akihiro Kawasaki.*** *Makromolekulare Chemie*, v. 39, no. 3, Aug. 1960, p. 243-245.

13916* Polyester Glass Plastic Laminates. Examination of physical properties with data on mechanical strength. *Mechanical World and Engineering Record*, v. 140, Sept. 1960, p. 374-377.

13917 Metallizing of Plastics. Details for carrying out every commercial metallizing process for plastics or other nonconductors. Deals with actual production procedures, formulations, and techniques for all known metallizing methods. ***Harold Narcus.*** 208 pp. 1960. Reinhold Publishing Corp., New York. (TP986.A2 N16m)

13918 An All-Hydrocarbon Thermosetting Resin for Electrical Insulation. Buton A-500, a new all-hydrocarbon thermosetting resin possesses considerable potential in the electrical field. Its attractive features include high resistance, low loss factor and dielectric constant, very low water absorption, high dielectric strength, and good arc resistance. ***Hadden Clark and R. G. Adams.*** *Modern Plastics*, v. 37, no. 12, Aug. 1960, p. 132 + 3 pages.

13919* The Stability of Polyvinylchloride. Literature on the subject of p.v.c. stability is contradictory and fundamental knowledge of the subject is still lacking. Discusses range of stabilizers available and illustrates the value of using mixed stabilizers. ***D. P. Dodgson.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Aug. 1960, p. 576-582.

13920* Plasticisers and Polymers Derived From Fats. Reviews hydroxystearic acids and their derivatives, epoxidized fats and fat derivatives, phosphorus derivatives of fats, and polymers. ***W. C. Ault.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Sept. 1960, p. 631-639.

13921 Highly Styrenated Epoxide Esters. New methods of preparing epoxide esters with a high content of styrene, low acid value and good viscosity characteristics. These products have good compatibility with hardening resins and can be used to prepare white stoving finishes with excellent resistance properties. ***W. E. Allsebrook.*** *Paint Manufacture*, v. 30, Sept. 1960, p. 317-320.

13922* Tinging of Polytetrafluorethylene (PTFE) Using Radiation-Chemical Graft Copolymerization. Grafting by slightly grafted polymers is shown to be able to produce well colorable polytetrafluorethylene films without doing mentionable harm to mechanical properties of the film. Comments given include grafting methods, monomers, kinetics, tinging of films, and properties of tinged films. (*In German.*) Die Herstellung von anfärbbarem Polytetrafluoräthylen (PTFE) mit Hilfe strahlenchemischer Pfropf-Kopolymerisation. ***J. Dobó, A. Somogyi, and E. Lakner.*** *Plaste und Kautschuk*, v. 7, Aug. 1960, p. 393-395.

13923 The Properties of Nylon 11. Nylon 11, Ralsin, compared with other polyamides has a lower melting point, is somewhat softer and has a lower water absorption. These properties in turn lead to a greater ease of processing, mechanical flexibility and toughness, and a high degree of dimensional stability. ***J. G. Hawkins.*** *Plastics (London)*, v. 25, Aug. 1960, p. 299-301.

13924* Improved Techniques for Extrusion of "Teflon" 100 FEP-Fluorocarbon Resin. How to extrude the resin at speeds previously impossible for the original Teflon resin. ***J. A. Blair and H. J. Haon, III.*** *Plastics Technology*, v. 6, Aug. 1960, p. 39-41.

13925* A New Weathering Stabilizer for Poly (Vinyl Chloride) Plastic. Hexamethylphosphoric triamide (HPT) is effective when properly formulated. ***H. W. Coover, Jr., R. L. McConnell, G. C. Newland, and J. W. Tamblyn.*** *Plastics Technology*, v. 6, Aug. 1960, p. 45 + 3 pages.

13926* Long-Term Durabilities of Polyesters in Glass-Reinforced Parts. Results of exposures of up to five years demonstrate the superiority of acrylic-polyester over straight-acrylics. ***A. L. Smith and J. R. Lowry.*** *Plastics Technology*, v. 6, Aug. 1960, p. 50 + 5 pages.

13927* Progress in Polymer Research. Techniques available to prepare polythenes of specific gravity—from 0.925 to 0.970: free radical initiated polymerization of ethylene with or without the presence of an organic liquid as solvent or vehicle, at temperatures above 100 C and at pressures around 1,000 atm; Ziegler type catalysts based on $TiCl_4$; and Al trialkyls and activated Al- or Ti-oxide catalysts used as fixed or fluid bed systems. *Rubber Journal and International Plastics*, v. 139, no. 6, Aug. 6, 1960, p. 193 + 4 pages.

13928* Molecular Weight of Carbochain Polymers as a Function of the Degree of Dispersity Resulting From Mechanical Comminution. Powdered vibrodispersion products of polystyrene and polymethyl methacrylate are separated into fractions of varying dispersity. Viscometric molecular weight determinations reveal the existence of a correlation between the molecular weight and the particle dispersity. ***N. K. Baramboim and V. N. Gorodilov.*** *Rubber Journal and International Plastics*, v. 139, no. 9, Aug. 27, 1960, p. 301 + 1 page.

13929* Makrofol Polycarbonate. Gives properties of this electrical insulating foil. ***Hofmeier.*** *Rubber Journal and International Plastics*, v. 139, no. 10, Sept. 3, 1960, p. 355-356.

13930* Radiation Work in Polymers. Summaries are given of six lectures dealing with various aspects of polymerization and cross-linking at the Moscow Symposium of Macromolecular Chemistry. *Rubber Journal and International Plastics*, v. 139, no. 11, Sept. 10, 1960, p. 376 + 2 pages.

13931* Porous Plastic Laminates. Method developed for the preparation of porous laminates and delineates their properties. ***James T. Hill, Egbert de Vries, and Fred Leonard.*** *SPE Journal*, v. 16, Sept. 1960, p. 1047-1051.

13932* Coloring Linear Polyethylene. Screening tests for determining what pigments may be used: color migration, fading due to ultraviolet light, and heat stability. ***P. E. Campbell, R. J. Martinovich, and T. V. Gay.*** *SPE Journal*, v. 16, Sept. 1960, p. 1052-1055.

13933 Silicone Rubber Insulation Beats Hyper-Environments. Silicone rubber has a long service life at temperatures of up to 150 C, is useful in many applications at 200 C, and can be used successfully for short periods at even higher temperatures. ***Oakley F. Hoyt.*** *Space/Aeronautics*, v. 34, no. 3, Sept. 1960, p. 109-110.

13934* Radical Polymerization of Styrene in Liquid Sulfur Dioxide. Reaction carried out with α,α'-azo-bis-(isobutyronitrile) as the initiator temperatures selected were 40, 50, and 60 C. ***Niichiro Tokura and Minoru Matsuda.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 12, no. 3, June 1960, p. 280-290.

See also: **13084** (plastic analysis by gas-liquid chromatoggraphy); **13210** (polymers from polyunsaturated fatty ethers); **13349** (osmotic pressure of polymer solutions); **13855** (effects of gamma radiation on the dielectric porperties of phenolformaldehyde plastics).

POLLUTION AND WASTES

13935* Automotive Air Pollution: A Systems Approach. The minimum acceptable efficiency for a device to control present pollution levels is 80%. ***Stuart L. Ridgway and John C. Lair.*** *Air Pollution Control Association, Journal*, v. 10, no. 4, Aug. 1960, p. 336-340.

13936* Chemical and Colicidal Effects of Halogens in Sewage. ***Jack E. McKee, Charles J. Brokaw, and Ronald T. McLaughlin.*** *Water Pollution Control Federation, Journal*, v. 32, Aug. 1960, p. 795-819.

13937* Wet Oxidation of Sewage Sludge. Basically, the process is chemical oxidation, under pressure, and at elevated temperatures, of combustible material in water or suspension. Atmospheric oxygen is the oxidant and the organic matter of sewage sludge is the combustible material. Total solids reduction averaged 67.3% in the pilot plant. ***E. Hurwitz and William A. Dundas.*** *Water Pollution Control Federation, Journal*, v. 32, Sept. 1960, p. 918-929.

See also: **13048** (metal treatment waste water purification).

RUBBER AND ELASTOMERS

13938* Some Possible Uses of Radioisotopes in the Rubber Industry. A survey of experimental data acquired from the evaluation of the wear of tires, from the control of the homogeneity of rubber compositions, and from the contactless measurement of the thickness of rubberized cords. The methods described are generally based on the use of β radiation absorption. (*In Russian.*) Nekotorye vozmoshnosti ispol'zovaniia radioaktivnykh izotopov v rezinovoĭ promyshlennosti. ***I. Shimorda, M. Mozhishek, L. Klimanek, and I. Staroba.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 16 pp. (QC770 C76pr)

13939 Fluorosilicone Rubber. Good solvent resistance and wide temperature application make these compounds suitable for use in jet aircraft. Commercial-grade caulking stocks may also be a possibility. ***O. R. Pierce, G. W. Holbrook, O. K. Johannson, J. C. Saylor, and E. D. Brown.*** *Industrial and Engineering Chemistry*, v. 52, Sept. 1960, p. 783-784.

13940* Development of Cast Urethane Elastomers for Ultimate Properties. Variations in properties that can be obtained by structural changes arising from the use of different polyesters, diisocyanates, chain extenders, and cross linking. ***K. A. Pigott, et al.*** *Journal of Chemical and Engineering Data*, v. 5, no. 3, July 1960, p. 391-395.

13941* Improvement of Thermal Conductivity of Chemically Resistant Rubbers. I. Thermal Conductivity Measurements. Compounding of natural and synthetic rubbers was studied to achieve in rubber the chemical resistance and thermal conductivity comparable to those of glass used for lining chemical equipment. Describes an apparatus designed for rapid determination of the thermal conductivity of rubbers. ***A. U. Momin, U. Shankar, and N. P. Suryanarayana.*** *Journal of Scientific & Industrial Research*, v. 19A, May 1960, p. 215-218.

13492* Boron-Siloxane Elastomers. Organopolysiloxanes containing more than 0.5 mol.% boron, are susceptible to hydrolysis and cannot be cross-linked to form elastomers. Heterocondensates based on organopolysiloxanes and boric acid and organoboric acids with molecular weights of 100,000 to 600,000 can be cross-linked to form elastomers if they contain less than 0.5 mol.% boron. These elastomers fuse together even in the fully cross-linked state at room temperature. They are not susceptible to hydrolysis, have excellent electrical properties even after immersion in water, and are used, among other things, as electrical insulation taps. (*In German.*) Bor-Siloxan-Elastomere. ***M. Wick.*** *Kunststoffe*, v. 50, Aug. 1960, p. 433-436.

13943 Another Synthetic Rubber Breakthrough. A new polymer desolventizer system was developed which consists of extruding parallel filaments of viscous solutions of elastomers on a belt into a fast-flowing stream of steam-heated water. The solvent from the polymerization process is evaporated and recovered from a steam-vapor mixture. The filaments combine in the desolventizer and form a continuous rubber sheet. The chief advantage of this processing system is the low cost of capital investment and operating cost. *Petroleum Week*, v. 11, no. 9, Sept. 2, 1960, p. 27.

13944* Compounding Light Colored Rubber Rolls. Guide to production stocks—based on four commonly used elastomers. ***Ralph F. Wolf and Robert R. Meltz.*** *Rubber Age*, v. 87, no. 6, Sept. 1960, p. 1001-1012.

13945* Compounding Elastomers for Rubber to Metal Adhesion. New method useful for measuring small differences in rubber-metal adhesion. ***William M. DeCrease.*** *Rubber Age*, v. 87, no. 6, Sept. 1960, p. 1013-1019.

13946* Swelling of Reinforced Elastomers in Boiling Water. Provides data that can be used in predicting more accurately the extended service life of a gasket or seal compound. Water absorption studies were conducted to help rubber technologists to equip steam and hot water systems. Data is given on polymers and fillers point to impurities as the major bottleneck. ***S. Palinchak and W. J. Mueller.*** *Rubber Age*, v. 87, no. 6, Sept. 1960, p. 1020-1027.

13947* Fundamentals of Failure Phenomena in Rubbers. Symposium on failure phenomena in rubbers reviewed. *Rubber and Plastics Age*, v. 41, Aug. 1960, p. 917.

13948* Butyl Tyres To-Day. Basic principles and techniques to be considered in the manufacture of butyl tires together with some of the performance characteristics to be expected of them. ***R. M. Mineo, A. J. Wallace, and R. L. Zapp.*** *Rubber and Plastics Age*, v. 41, Aug. 1960, p. 925 + 3 pages.

13949* The Stereoregular Polymerization of Isoprene With Lithium and Organolithium Compounds. Alkali metals catalyze the polymerization of dienes such as butadiene and isoprene. A stereoregular polymer is obtained when the polymerization of isoprene is catalyzed by lithium or organolithium compounds in the absence of O containing solvents. The polymer has molecular structure, configuration, and physical properties similar to Hevea rubber, and a microstructure comprised of 93-95% *cis*-1,4 and 5-7% 3,4 addition. ***R. S. Stearns and L. E. Forman.*** *Rubber Chemistry and Technology*, v. 33, no. 3, July-Sept. 1960, p. 595-609. (Reprinted from *Journal of Polymer Science*, v. 41, 1959, p. 381-397.)

13950* The Copolymerization of Isoprene and 1,3-Butadiene by Butyllithium. Relative reactivity of the diene hydrocarbons, isoprene, and 1-3-butadiene, which differ by only a methyl group, in alkali-catalyzed copolymerization. Uses labeled atoms for determining the composition of the copolymers. ***G. V. Rakova and A. A. Korotkov.*** *Rubber Chemistry and Technology*, v. 33, no. 3, July-Sept. 1960, p. 623-627. (Translated from *Doklady Akademiia Nauk SSSR*, v. 119, 1958, p. 982-985.)

13951* The Crystallization of Modified Cis-Polybutadiene. Describes measurements on peroxide-cured samples and on samples in which the *trans*-1,4 content was increased by isomerization. The purpose of these measurements was to establish the effectiveness of the introduction of various types of points of disorder in retarding or preventing the formation of crystals. ***G. S. Trick.*** *Rubber Chemistry and Technology*, v. 33, no. 3, July-Sept. 1960, p. 699-702. (Reprinted from *Journal of Polymer Science*, v. 41, no. 138, 1959, p. 213-217.)

13952* Adhesion Phenomena in the Bonding of Rubber to Metal by Means of Leĭkonat Bonding Agent. II. Unfilled Vulcanized Rubber. ***B. V. Deryagin, S. K. Zherebkov, and A. M. Medvedeva.*** *Rubber Chemistry and Technology*, v. 33, no. 3, July-Sept. 1960, p. 757-762. (Translated from *Kolloidnyĭ Zhurnal*, v. 21, 1959, p. 558-563.)

13953* Oil Migration Study. Oils, similar to other compounding ingredients, tend to migrate from an elastomer containing higher amount of oil into a relatively oil-free compound, both between cured and uncured stocks. Significant amount of oil migrates during vulcanization, whether the oil-acceptor compound is oil-resistant or not. ***Frank Kadlec and Ray Thoman.*** *Rubber World*, v. 142, no. 5, Aug. 1960, p. 97-103.

13954* Available Dry Styrene-Butadiene Rubbers (SBR)—United States and Canada. Compilation of changes and additions to grades of SBR offered by suppliers. *Rubber World*, v. 142, no. 5, Aug. 1960, p. 107-112.

13955* Environmental Resistance of Estane Urethane Materials. Elastomer exhibits superior gamma radiation resistance consistent with its low cross-linking value; good ultraviolet radiation resistance may be obtained with carbon black and ultraviolet absorbers. ***C. S. Schollenberger, L. G. Pappas, J. C. Park, and V. V. Vickroy, Jr.*** *Rubber World*, v. 142, no. 6, Sept. 1960, p. 81-88.

13956 Dichlorobenzidine as a Curing Agent for Adiprene L-100. Cast polyurethane elastomer with exceptional physical properties obtained by curing the prepolymer Adiprene L-100 with dichlorobenzidine. System was valuable in applications requiring a casting resin of extreme thermal-shock resistance. ***A. J. Quant.*** *U. S. Atomic Energy Commission, SCR-187*, Sept. 1960, 14 pp. (UF767 Un3.1scr Contin.)

SPACE HEATING AND CONDITIONING

13957 Weather Does Affect Mortality. Air conditioning, while increasing man's over-all comfort level, also is bringing about a gradual trend toward a lessening of the weather-mortality response. ***P. H. Kutschenreuter.*** *ASHRAE Journal*, v. 2, Sept. 1960, p. 39-43.

13958 A Look at Today's Absorption Refrigeration. Traces the improvements of the last 15 years and reviews the present day absorption refrigeration cycle. ***S. E. Johnson.*** *ASHRAE Journal*, v. 2, Sept. 1960, p. 55-59.

13959 Precise Measurement of Clothes Insulation During Controlled Operation of the Human. It is possible to measure the resistance of clothing as an ohmic relation between time-averaged equilibrium values of the flux of power (metabolism) and the potential difference between average skin temperature and ambient temperature. Specifically, this has been demonstrated on the human in what has been referred to as the comfort mode of operation of the human system. With control attempted to approximately 0.1 C, sufficient precision has been achieved to resolve 1 or 2% difference in clothes resistance. ***A. S. Iberall.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 3, Sept. 1960, p. 513-527.

13960* French Powerformer Has One of World's Largest Vertical Tubular Heaters. Gives a description of the heater in detail. *Heat Engineering*, v. 35, no. 4, July-Aug. 1960, p. 152-153.

13961* The Case for Central Electric Furnaces. Another contribution to the "great debate" on electric heating with ducted air systems, states that this type of equipment offers advantages in original cost, flexibility, and economy of operation. ***W. R. Pindell.*** *Heating & Air Conditioning Contractor*, v. 51, no. 11, Aug. 1960, p. 59-64.

13962* This Year's Cooling Market: Good, but Not Great. Cool weather has again taken its toll in the air conditioning business. Commercial-industrial volume has held up best. *Heating & Air Conditioning Contractor*, v. 51, no. 11, Aug. 1960, p. 74-75.

13963* Heat Pump Utilizes Artesian Wells. Eastwood Shopping Center in Birmingham, Ala., is one of the largest water-to-air heat pump installations to utilize artesian wells. *Heating & Air Conditioning Contractor*, v. 51, no. 11, Aug. 1960, p. 76-78.

13964 Air Conditioning With Polyester Bags. Jet passenger comfort is improved, air leakage reduced, and installation cut by 20% through use of fabricated polyester bags installed in walls of craft. *Modern Plastics*, v. 37, no. 12, Aug. 1960, p. 88-89.

TEXTILES, FIBERS, LEATHER, AND PAPER

13965* The Effect of Hide Location and Cutting Direction on the Tensile Properties of Upper Leathers. Skins cut parallel to the backbone showed the same general pattern of variation over the hide, and skins cut perpendicular showed a different but equally definite pattern of variation from one hide location to another. Test results show that the tensile strength and the resistance to stretch at high load follow the same pattern of variation that was indicated in the above tests. ***Mieth Maeser.*** *American Leather Chemists Association, Journal*, v. 55, Sept. 1960, p. 501-530.

13966 The Manufacture and Testing of Durable Book Papers. ***Randolph W. Church, editor.*** 63 pp. 1960. The Virginia State Library, Richmond, Va. (Z701 B27m)

13967* Studies on the Possibilities of Using Radioactive Tracers to Follow the Penetration of Cooking Liquors Into Wood. ***Waldemar Jensen, B. C. Fogelberg, and Monica Johanson.*** *Paperi ja Puu*, v. 42, no. 7, July 1960, p. 393-400.

13968* Effects of Mechanical Chips Treatment on Pulp and Paper Properties for Kraft Cooking of Softwood. ***P. Colombo, D. Corbetta, A. Pirotta, and G. Ruffini.*** *Svensk Paperstidning*, v. 63, no. 15, Aug. 15, 1960, p. 457-471.

13969* The Structure of Paper. I. The Statistical Geometry of an Ideal Two Dimensional Fiber Network. The geometry and structure of two-dimensional sheets are described in terms of the means and distributions of eight geometric properties which are closely related to the mechanical, optical, and porous properties of paper. The equations are derived from probability theory and can be evaluated in terms of the number of fibers in a sheet and their dimensions. ***O. Kallmes and H. Corte.*** *Tappi*, v. 43, Sept. 1960, p. 737-752.

13970* The Slime Board Method of Paper Mill Toxicant Evaluation. Describes a device which can be used in the laboratory and on paper machines for the evaluations of toxicants. The laboratory model is a system in which an artificial white water is circulated over the slime boards. The measure of microbiological toxicity is determined by making plate counts of the accretion. ***C. R. Leckey.*** *Tappi*, v. 43, Sept. 1960, p. 781-783.

13971* Fabric Structure and Wash-and-Wear. ***E. James Stavrakas and Milton M. Platt.*** *Textile Industries*, v. 124, Oct. 1960, p. 141-160.

13972* Chemical Attack of Textile Fibres. II. Protein Fibres: (C) Regenerated Proteins. Casein fibers are rapidly degraded by strong oxidizing agents such as concentrated hydrochloric acid. Groundnut protein fibers are fairly resistant to acids. Maize proteins (vicara) are very resistant to acids. ***F. O. Howitt.*** *Textile Institute, Journal, Proceedings*, v. 51, July 1960, p. 321-325.

13973 Twenty-Five Years of Man-Made Fibres. Discusses terylene, acrylic fibers, polyamides, polypeptides, fibers based on polyvinyl alcohol, new methods of synthesis, and fibrous and isotactic polymers. ***Harry Melville.*** *Textile Institute, Journal, Proceedings*, v. 51, Aug. 1960, p. P382-P391.

13974 The Chemistry of Protein Fibres. Silk, the heterogeneity of wool, the molecular skeleton, cystine linkages, intramolecular reactions, amino-acid analysis and sequence, fractionation of keratin are discussed. ***J. B. Speakman.*** *Textile Institute, Journal, Proceedings*, v. 51, Aug. 1960, p. P392-P407.

13975 Biological Perspectives in Textile Research. Reviews trends in biological research, production of raw materials, insect repellents, microbial decomposition of cellulose, and mildew proofing of cellulosic textiles. ***R. G. H. Siu.*** *Textile Institute, Journal, Proceedings*, v. 51, Aug. 1960, p. P439-P449.

WELDING AND JOINING

13976 Recent Developments in Titanium Brazing. Discusses brazing filler metals, brazing methods, mechanical properties of brazed joints, effects of brazing cycles on base-metal properties. ***G. E. Faulkner and W. J. Lewis.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 45, Mar. 4, 1960, 8 pp. (TN799 B32.2d Contin.)

13977 Brazing for High-Temperature Service. Summarizes the extent of advancement in the field of brazing for service temperatures in excess of 600 F. Until recently, the silver-base and copper-base alloys were the most common in the brazing field. These alloys were not suitable for high-temperature service. The nickel-chromium-iron alloys were the first to be used for high-temperature service. Nickel-base alloys, especially those containing Cr, exhibit good high-temperature strength and oxidation resistance. ***A. F. Haskins and R. M. Evans.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 48, Mar. 29, 1960, 14 pp. (TN799 B32.2d Contin.)

13978 Notes on the Diffusion Bonding of Metals. The open literature is replete with reports on fundamental studies of diffusion phenomena. Most of these have not been directed toward bonding per se, but rather toward learning more about the fundamental reactions that take place. The metals-joining industry is in need of basic research and development work required to indicate better the problems and their solutions. With such information, a precise science of diffusion bonding can be

delineated for joining the complex alloys available today and being developed for the future. ***R. M. Evans.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 53, Apr. 20, 1960, 9 pp. (TN799 B32.2d Contin.)

13979 Problems With Restraint in Heavy Weldments. The Bureau of Naval Weapons, in conjunction with the Bureau of Ships, is initiating research under the Titanium Alloy Sheet Rolling Program to evaluate thick Ti plate for use in deep-diving submarines. One of the important phases of this research is the evaluation of welded joints in thick titanium-alloy plates. As part of the weld-evaluation program, procedures will be developed for welding 2-inch-thick plates. These plates will be 30 inches long. Restraint in weldments of this size is high. This memoradum is the text of a talk presented at the Titanium Alloy Sheet Rolling Panel Meeting, Jan. 18, 1960, in San Diego. ***Glenn E. Faulkner.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 54, Apr. 29, 1960, 6 pp. (TN799 B32.2d Contin.)

13980 Welded Fabrication of Steel Solid-Propellant Rocket-Motor Cases. The development of solid-propellant rockets has suddenly increased the use of thin sections of high-strength steels. Solid-propellant rocket-motor cases must be lightweight and at the same time must withstand high internal pressures at fast loading rates. Welding currently provides the most efficient fabrication techniques for the production of light, high-strength cases. The successful production of these cases requires extensive welding fabrication known-how. The high percentage of failures of rocket-motor cases during hydrotesting attests to the need for better welding-fabrication techniques. ***M. D. Randall, R. E. Monroe, and P. J. Rieppel.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 56, May 31, 1960, 28 pp. (TN799 B32.2d Contin.)

13981 New Developments in the Welding of Metals. Describes progress made with new methods of welding metals. Discusses the applications and limitations of fusion welding, resistance welding, brazing, solid-state bonding, and plasma jet cutting and coating, along with brief descriptions of how the process works and what was done with it. ***P. J. Rieppel.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 131, June 24, 1960, 48 pp. (TN799.T5 B32.7t Vis.)

13982 The Influence of Welding on the Design of Ships. The application of welding to ships has had a revolutionary effect on both the design and production of ships. Apart from the pioneering work, the changes have all come about during the past 20 years. ***W. G. John.*** *British Welding Journal,* v. 7, Aug. 1960, p. 491-502.

13983 Discussion at the Symposium on: Fatigue of Welded Structures. Symposium held at Cambridge University from Mar. 29 to Apr. 1, 1960, jointly organized by the British Welding Research Association and the Engineering Department of the University. Treats the four papers presented in Sessions III and IV. *British Welding Journal,* v. 7, Aug. 1960, p. 513-529.

13984 Hydrogen in Welding. A Comparison Between the Behaviour of Welded, Cast, and Wrought Steel. The knowledge gained concerning the effect of H in steel, mainly in forged or rolled steel, can be used to attempt to clarify the phenomena caused by this gas in welding. ***Paul G. Bastien.*** *British Welding Journal,* v. 7, Sept. 1960, p. 546-557.

13985 Fatigue Strength of Beams With Stiffeners Welded to the Tension Flange. Contains details of fatigue tests carried out on beams having web stiffeners welded to the tension flange both transversely and longitudinally. ***T. R. Gurney.*** *British Welding Journal,* v. 7, Sept. 1960, p. 569-576.

13986 Discussion at the Symposium on Fatigue of Welded Structures. Symposium was held at Cambridge University from Mar. 29 to Apr. 1, 1960, jointly organized by the British Welding Research Association and the Engineering Department of the University. Discusses the last four papers presented in Sessions V and VI. Discussion on first seven papers published in July and Aug. issues. *British Welding Journal,* v. 7, Sept. 1960, p. 577-587.

13987 Some Problems of Crystallization Cracking in Electroslag Welding. The orientation and location of crystallization cracks in electroslag weld metal, relation between feed rate and cracking were investigated. ***S. A. Ostrovskaya.*** *Henry Brutcher Translation No.* 4866, 22 pp. + 9 figures. (From *Avtomaticheskaya Svarka,* v. 10, no. 4, 1957, p. 33-47.) Henry Brutcher, Altadena, Calif.

13988* Why Not More Welded Structures? Structural engineers have not designed welded structures as extensively as they should to cut costs. ***Van Rensselaer P. Saxe.*** *Civil Engineering,* v. 30, Aug. 1960, p. 53-55.

13989* Friction Welding: A Practical Process. The direct conversion of mechanical to thermal energy used in friction welding machine gives it a low-energy consumption. This should make friction welding an attractive process. *Engineering,* v. 190, Aug. 19, 1960, p. 250-251.

13990* Pressure Vessels Can Be Welded. Influenced by the need to use materials of nonstandard specifications for certain work in making solid-fuel rocket motor cases, Bristol Aerojet decided to establish its own material specifications for pressure vessel work, if by so doing, the problems of ensuring the necessary weld quality could largely be removed. This has proved to be a wholly practical solution. ***David Fishlock, editor.*** *Metalworking Production,* v. 104, no. 36, Sept. 7, 1960, p. 77-80.

13991 Automatic Welding of Large Storage Tanks. Applications of new CO_2 site welding equipment. *Welding and Metal Fabrication,* v. 28, Aug. 1960, p. 309-315.

13992 High Strength Bolting. One of the most important changes in structural engineering for many years was the introduction of high strength friction grip bolts as a replacement for site riveting. It is doubtful if any new development, having such a wide application, has so readily been accepted as a standard of practice. ***Howard Martin.*** *Welding and Metal Fabrication,* v. 28, Aug. 1960, p. 325-329.

13993* The Newest Ways to Cut and Join Magnesium. Significant new processes for joining magnesium alloys to each other and to aluminum alloys are on the production line. Others are ready for it; still others show great promise for future production use. ***T. L. Patton.*** *Welding Design & Fabrication,* v. 33, Oct. 1960, p. 39-41.

13994* Techniques for Fabricating and Welding Clad Steels Thicker Than 2-Inches. Heavy-clad steels are as easy to fabricate and weld as their thinner-gage cousins if you take into consideration certain slight differences in techniques. ***Albert Hoersch, Jr.*** *Welding Design & Fabrication,* v. 33, Oct. 1960, p. 42 + 2 pages.

13995 Effect of Steel Backup Blocks on Series-Spot Welding. Effect of substituting steel, a low-conductivity material, for Cu and its alloys as a backup material is determined through WRC sponsored investigation. ***E. F. Nippes, W. F. Savage, and K. C. Wu.*** *Welding Journal,* v. 39, Aug. 1960, p. 321s-326s.

13996 Calculations for Temperature Response in Spot Welds. Objective of calculation is to provide a conservative determination for the time required by a weld to reach fusion temperature. ***G. R. Archer.*** *Welding Journal,* v. 39, Aug. 1960, p. 327s-330s.

13997 Fundamental Studies of Ultrasonic Welding. Studies related to ultrasonic welding are made to determine the mechanism of bonding, the effects of welding variables and the effects of material factors. ***N. E. Weare, J. N. Antonevich, and R. E. Monroe.*** *Welding Journal,* v. 39, Aug. 1960, p. 331s-341s.

13998 Weldability of Aluminum Casting Alloys With 5086 Wrought Aluminum Alloy. In producing a ballistic missile, the joining of cast attachments to the thin wrought aluminum-alloy skin must be carefully considered. ***M. S. Orysh and I. G. Betz.*** *Welding Journal,* v. 39, Aug. 1960, p. 342s-351s.

13999 Low-Temperature Properties of Welded Magnesium Alloys. Provides additional data on the newer magnesium-alloy compositions and on the properties of welds in these alloys at low temperatures. ***R. W. Fenn, Jr. and L. F. Lockwood.*** *Welding Journal,* v. 39, Aug. 1960, p. 352s-356s.

14000 Circular-Patch Test for Evaluating Armor Crack Susceptibility. Object is to determine the suitability of the circular patch as a test of the susceptibility of base metal to cracking in welded joints of Ordnance armor-steel weldments.

Laurence E. Poteat and Richard W. Jones. *Welding Journal*, v. 39, Aug. 1960, p. 357s-364s.

14001 Assembly-Line Fabrication of All-Welded Aluminum Covered-Hopper Cars. Development of the inert-gas metal-arc welding processes for Al, both manual and automatic, has opened up many new applications for the light metal. One of the larger and more interesting applications is in fabrication of all-welded Al covered-hopper cars. ***Dana V. Wilcox and Ronald Hubbard.*** *Welding Journal*, v. 39, Aug. 1960, p. 783-790.

14002 A New Electron-Beam Welding Unit. High-power electron beams in vacuum have recently been adapted for several metallurgical processing applications. ***W. J. Greene, R. R. Banks, and R. M. Niedzielski.*** *Welding Journal*, v. 39, Aug. 1960, p. 791-796.

14003 Complex Steel Weldments. Twin 90-ft-diam mobile radio telescopes, weighing 175 tons each, require special precautions in shop and field assembly. ***J. August Rau and William F. Fischer.*** *Welding Journal*, v. 39, Aug. 1960, p. 808-812.

14004 Spot Welding of Wrought HK31A, HM21A, and ZE10A Magnesium Alloys. Presents information on the spot welding of the newer wrought magnesium-base alloys using three-phase, low-frequency, converter-type spot-welding equipment. ***Lloyd Lockwood.*** *Welding Journal*, v. 39, Sept. 1960, p. 369s-378s.

14005 Brittle-Fracture Tests of Six-Foot Wide Prestressed Steel Plates. Series of tests is conducted to determine the effects of a residual-strain field on brittle-fracture propagation. Studies fracture speed and strain field associated with propagating crack. ***F. W. Barton and W. J. Hall.*** *Welding Journal*, v. 39, Sept. 1960, p. 379s-384s.

14006 Studies on Repair Welding Age-Hardenable Nickel-Base Alloys. Main objective of laboratory investigation is to develop and evaluate techniques of repair welding that would prevent failure during subsequent heating to the temperatures where their ductilities are low. Repair welding of two age-hardenable nickel-base alloys, René 41 and Astroloy, was studied. Repair welds were made on restrained, aged material by several techniques. Samples were then subjected to thermal cycles simulating jet-engine operation. ***W. J. Lepkowski, R. E. Monroe, and P. J. Rieppel.*** *Welding Journal*, v. 39, Sept. 1960, p. 392s-400s.

14007 A New High-Temperature Manganese-Base Brazing Alloy. To meet the demands of the jet and rocket industry, brazing alloys were developed, having good self-fluxing properties, so that no special cleaning practice after brazing is required. ***Raymond C. Kopituk.*** *Welding Journal*, v. 39, Sept. 1960, p. 401s-405s.

14008 Some Factors Affecting the Weldability of the Cupro-Nickels. Investigation covers the reason for fusion-line cracking, the source of most of the welding difficulties encountered with cupro-nickel alloys. ***C. E. Witherell.*** *Welding Journal*, v. 39, Sept. 1960, p. 411s-416s.

14009 Research and Development of Continuous-Welded Rail. More than one-half of new rail being laid this year has welded joints. ***G. M. Magee.*** *Welding Journal*, v. 39, Sept. 1960, p. 881-889.

14010 Welding of Triton, World's Largest Nuclear-Powered Submarine. Involved were many diversified operations ranging from heavy multipass welds on hull plating to minimum-size deposits on small-diameter reactor-instrumentation tubing. ***G. W. Kirkley, Jr.*** *Welding Journal*, v. 39, Sept. 1960, p. 893-902.

14011 Activities of Commission V—International Institute of Welding. This commission has intensified efforts in the investigation of radiographic, ultrasonic, penetrant and magnetic-test methods. ***R. A. Pulk.*** *Welding Journal*, v. 39, Sept. 1960, p. 908-914.

14012 Volatilization Phenomena in High-Temperature Brazing Filler Alloys. Development program results in oxidation-resistant brazing filler alloys containing liquidus temperature depressants which can be volatilized during brazing. ***William Lehrer and Harry Schwartzbart.*** *Welding Journal*, v. 39, Oct. 1960, p. 449s-461s.

14013 Proposed Procedure for Testing Shear Strength of Brazed Joints. Proposes an extension of a test mentioned in a paper by Miller and Peaslee in the April 1958 issue of the Welding Journal. ***W. Lehrer and H. Schwartzbart.*** *Welding Journal*, v. 39, Oct. 1960, p. 462s-464s.

14014 Designing for Production Welding Gives Industry a Fully Accessible Motor. Motor that simplifies inspection and maintenance, has interchangeable parts, operates at reduced noise levels, and is produced by production-line techniques. ***A. L. Cooper and W. H. Morse.*** *Welding Journal*, v. 39, Oct. 1960, p. 1015-1021.

14015* The Present-Day Development of Covered Electrodes for Arc Welding of Ferrous Materials. Despite many attempts to introduce semi- or fully-automatic methods into arc welding, manual welding with covered electrodes must still be regarded as the most frequently used method. Describes the importance of the welding electrode in the method mentioned above, in relation to present-day experiences. ***K. L. Zeyen.*** *Wire*, no. 48, Aug. 1960, p. 114-120.

See also: **13608** (annealing of butt welded steels).

MISCELLANEOUS

14016* An Alternative to Set Theory. Discusses an alternative to set theory which provides not only a conceptual basis for analysis free from the difficulties that trouble set theory, but also a mathematical language with some technical advantages over set theory. ***P. C. Gilmore.*** *American Mathematical Monthly*, v. 67, no. 7, pt. 1, Aug.-Sept. 1960, p. 621-632.

14017* Elementary Point Set Topology. II. *R. H. Bing.* *American Mathematical Monthly* (Suppl.), v. 67, no. 7, pt. 2, Aug.-Sept. 1960, 58 pp.

14018* Matrices of Rational Integers. Reviews the theory of the unimodular group in n dimensions and that of the modular group with all its ramifications into number theory and function theory including complex multiplication. Discusses space groups and crystallography. ***Olga Taussky.*** *American Mathematical Society, Bulletin*, v. 66, no. 5, Sept. 1960, p. 327-345.

14019 Analytic Functions. Contains the principal addresses delivered at the Conference on Analytic Functions held September 2-14, 1957, at the Institute for Advanced Study, Princeton, New Jersey. Represent a comprehensive survey of recent developments both in the classical and modern fields of the theory of analytical functions. ***R. Nevanlinna, et al.*** 197 pp. 1960. Princeton University Press, Princeton, N. J. (QA321 C76a)

14020* Conference on the Use of Radioisotopes in the Physical Sciences and Industry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. (Russian Papers Only). Copenhagen, September 6-17, 1960. Twenty-two preprints of papers on sources and use of radioisotopes in studies of wear, lubricants, chemical synthesis and reaction kinetics, thickness measurements, ore flotation, geophysical prospecting, C-14 dating, diffusion processes, and hydrogeological studies. (*In Russian.*) Mezhdunarodnoe agentstvo po atomnoĭ energii. V sotrudnichestve s organizatsheĭ ob'edinennyh natsiĭ po voprosam obrazovaniia, nauki i kul'tury. Konferentsiia po primeneniiu radiozotopov v fizicheskikh naukakh i promyshlennosti. Kopengagen, 6-17 Sentiabria 1960. Papers individually paged. (QC770 C76pr)

14021* Dating With C^{14}. Description of a dating method measuring C^{14} with a proportional counter. CO_2 and ethane were used as counting gases. Using C_2H_2, ages 11,700 ± 300 years were determined for Salix wood; 6,100 ± 230 years for peat and wood of the Klaiped stratum, and 30,000 years for peat of the left bank of the Viliuia River. An age of 1,780 ± 180 years was measured on coal using CO_2. (*In Russian.*) Datirovanie po C^{14}. ***A. P. Vinogradov.*** Paper from "Conference on the Use of Radioisotopes in the Physical Sciences and In-

dustry in Co-Operation With the United Nations Education, Scientific and Cultural Organization. Copenhagen, September 6-17, 1960". 14 pp. (QC770 C76pr)

14022* The Two Aspects of Science. Determinism and long-range predictions, the interaction of subatomic particles, the partial atomicity seem in biology and astronomy—these are only a few of the partially charted regions on the large continent of ignorance. A fuller understanding will require a creativity that ranks with the best found in sculpture, music, and literature. ***George Thomson.*** *Discovery*, v. 21, Sept. 1960, p. 383-386.

14023* Interstate Highway Construction Can Make or Break a City. Only 60% of U.S. cities are taking full advantage of rebuilding opportunities offered by urban interstate highway construction, according to ENR's survey. ***Joseph F. Wilkson.*** *Engineering News-Record*, v. 165, no. 11, Sept. 15, 1960, p. 26-30.

14024 Re-Evaluating Existing Processes. Small processing changes over a period of time can change the safety hazards outlook of the original process markedly. ***Stanley F. Spence.*** *Industrial and Engineering Chemistry*, v. 52, Sept. 1960, p. 75A-76A.

14025* Cubic Formulas for the Calculation of the Moments of Functions of Two Variables. Formulas and calculations are cited. (*In Russian.*) Kubaturnye formuly dlia vychisleniia momentov funktsiĭ dvukh peremennykh. ***N. Ia. Vilenkin.*** *Izvestiia Vysshikh Uchebnykh Zavedenīĭ, Matematika*, 1960, no. 4, p. 49-54.

14026 Nomography. Emphasizes "the geometric method" in the development of the basic theory which is used for the design of alignment charts that may involve three or more variables. The treatment of the "determinant method" has been expanded considerably. The mathematical developments for the various type forms throughout the book are simplified, and many new problems and examples are introduced. Contains 58 nomograms in such fields as: statistics, tests and measurements, various branches of engineering, physical and biological sciences, food technology, heat transfer, satellite launching, and radioactivity. ***A. S. Levens.*** 2nd Ed. 296 pp. 1959. John Wiley & Sons, New York. (QA90 L57n2)

14027 Operational Calculus. Theories are explained in such a manner as to be of use both to an engineer, who regards the operational calculus merely as a tool in his work, and to the reader who is interested in proofs of theorems and mathematical problems for their own sake. ***Jan Mikusinski.*** 5th Ed. 495 pp. 1959. Pergamon Press, New York. (QA432 M58r2tr)

14028* A Multimove Infinite Game With Linear Payoff. Analysis of a multimove infinite game with a linear payoff function. The game is symmetric in every respect except that the initial conditions of the two players are different. It is proved that one player has an optimal pure strategy and that the other player must randomize on the strategies. The optimal strategies and game value are derived. ***Leonard D. Berkovitz and Melvin Dresher.*** *Pacific Journal of Mathematics*, v. 10, no. 3, Fall 1960, p. 743-765.

14029* Embedding of Algebraic Systems. The representation of semigroups and algebras by systems of transformations has proved useful in algebra. Paper develops a representation theory for systems with an arbitrary number of algebraic operations by systems of transformations. ***Gerald Berman and Robert J. Silverman.*** *Pacific Journal of Mathematics*, v. 10, no. 3, Fall 1960, p. 777-786.

14030* Irreducible Congruence Relations on Lattices. Studies the relationship between weak projectivity and projectivity of prime quotients. ***D. T. Finkbeiner.*** *Pacific Journal of Mathematics*, v. 10, no. 3, Fall 1960, p. 813-821.

14031* On the Dirichlet Problem for Certain Higher Order Parabolic Equations. Studies the Dirichlet problem for the particular equation $D_x^4 u + D_t u = 0$ $(D_\xi \equiv \partial/\partial\xi)$ on the space-time cylinder $(0<x<1)\theta(<t\leq T)$. ***R. K. Juberg.*** *Pacific Journal of Mathematics*, v. 10, no. 3, Fall 1960, p. 859-878.

14032* Infinitely Repeatable Games. Blackwell has introduced the concept of approachability in obtaining an analog of the von Neumann minimax theorem for games with vector payoffs. This paper continues the study. ***Melvin Katz.*** *Pacific Journal of Mathematics*, v. 10, no. 3, Fall 1960, p. 879-885.

14033* Maximal Means and Tauberian Theorems. Studies two well-known mathematical ideas that have hitherto been regarded as unconnected. Proposes to show that they are closely related. The first idea is one developed by Pólya in his theory of maximal density. The second is the idea of repeated differentiation introduced by Littlewood in Tauberian arguments. ***L. A. Rubel.*** *Pacific Journal of Mathematics*, v. 10, no. 3, Fall 1960, p. 997-1007.

14034* A Theory of Normal Curves and Some Applications. In the literature, from the point of view of combinatorial topology, there has been an emphasis on the study of curves as point sets in their own right and surprisingly little on their study as mapping directly. Relations between the intersections are defined and various properties of curves are described in terms of these relations. ***C. J. Titus.*** *Pacific Journal of Mathematics*, v. 10, no. 3, Fall 1960, p. 1083-1096.

14035* Psychometric Considerations in Selecting Personnel for Unusual Environments. Basic psychometric considerations underlying selection of military personnel for unusual environments are old principles which are useful in new situations. They apply to a wide range of situations—business and industrial as well as military—wherever the need is for relatively small numbers of personnel to fill highly important and critical positions. The unique selection problems are most likely to be found in the substantive rather than methodological domain. Such possible problems as sensory deprivation and "break-off" effect represent intriguing areas for research but any application to selection technology is still in the future. ***Abraham S. Levine.*** *Personnel Psychology*, v. 13, no. 3, Autumn 1960, p. 233-243.

14036* Supervisory Characteristics and Attitudes of Subordinates. The aim of the research was to establish more specifically which characteristics of chief petty officers in the U. S. Navy are most closely associated with influence on the morale and attitudes of their men. The research was carried out by obtaining appraisals of a variety of attributes of chiefs and relating these to crucial attitudes of the men working under them. The major conclusions of this study is that a high-status, mission-oriented chief wins the respect and admiration of the men not only for himself, but for his rate and the Navy in general. It is this respect rather than satisfaction with his working conditions, which is most apt to make a man overlook some of the stresses and strains, and to "go Navy". ***Aaron J. Spector, Russell A. Clark, and Albert S. Glickman.*** *Personnel Psychology*, v. 13, no. 3, Autumn 1960, p. 301-316.

14037* The Sensitivity of Employee Attitude Questionnaires. Instead of employing questionnaire data as the sole indicator of attitudes, it is suggested that interviews be considered as supplemental materials giving some context and additional meanings to the questionnaire scores. The questionnaire used with employees of a plant about to move its location appeared deficient in sensitivity since only a few items showed satistically significant changes in only one portion of the "disturbed" plant. Moreover, the changes in item scores were small compared to those that were possible and expected. ***F. K. Berrien and William H. Angoff.*** *Personnel Psychology*, v. 13, no. 3, Autumn 1960, p. 317-327.

14038* The Behavior and Personality of the Labor Mediator: The Parties' Perception of Mediator Behavior. The high over-all reliability of the ratings on all scales indicated that, as a group, raters were agreed on the relative standing of the mediators. A comparison of ratings from various subgroups of raters confirmed this general finding. In particular, labor and management did not systematically differ in their evaluation of mediators—indeed, there is some evidence that lawyers agree more with each other, regardless of the side to which they belong, than they agree with their clients. Further, it was found that "buddy ratings", i.e., ratings by colleagues, are extremely good predictors even in this rather unusual setting in which colleagues cannot see each other at work. ***Henry A. Landsberger.*** *Personnel Psychology*, v. 13, no. 3, Autumn 1960, p. 329-347.

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North Florida Research Station • Daytona Beach, Florida

OFFICES

9 Avenue Franklin D. Roosevelt • Paris VIII

24 Ryder Street • London S W 1

Vallehermoso, 18 • Madrid 15

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